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LECTURES
ON
COMPARATIVE ANATOMY
AND
ANIMAL PHYSIOLOGY,

DELIVERED BY

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LECTURE XLV.

ON THE DIGESTIVE ORGANS OF BIRDS AND MAMMALIA.

BIRDS are organized to consume the higher forms of animal and vegetable matter. They are vertebrated insects, and like their invertebrated analogues they seek their food in every element; they pursue it through the air, or plunge for it beneath the waters, or dig it from the solid earth; yet their arms are incapable of prehension, and are adapted solely for flight. The hand of the birds is their head, and their long muscular neck has all the flexibility and strength of an arm, to carry their prey through the air, or to tear it to pieces. The jaws of birds, like the jaws of chelonia, are covered with horny plates, which supply the place of teeth, and, consequently, vary in their forms according to the kind of food, like the teeth of quadrupeds. The broad, flat, depressed bills of the ducks and geese and swans, and other aquatic birds, with denticulated edges and highly sensible soft lips, are the best adapted for groping beneath the water or in mud, for worms or insects or fishes, which they cannot always perceive by the sight.

The spatulate jaws of the spoonbill are well adapted for extracting small worms from the muddy banks of rivers and lakes; those of the pelican, with a large submaxillary pouch, are fitted for seizing the fishes, as in a net; those of the cranes and storks for darting through the water with precision, like an arrow or a harpoon; and the long compressed bills, terminating in a hook, which we see in the cormorants, gulls, albatroses, and many sea birds, are constructed to seize firmly the smooth and scaly bodies of the fishes of the open seas. The broad bills, with cutting edges, of the struthious birds, are formed to prune the leaves and shoots of plants or the herbage of the plains; the long, narrow bills of the woodpeckers, to be inserted into the small crevices of the decayed bark of trees, to seize the minute insects which swarm there; and the numerous little insectivorous warblers and fly-catchers, wheat-ears and wag-tails, thrushes and wrens, have their bills of the same structure on a smaller scale. The beak is long and tubular in the humming-birds, to suck the honey from the flowers. But in the gros-beaks and cross-bills, the sparrows and buntings, and all the gramnivorous singing birds, and the larger gallinaceous birds, the bills are stronger and shorter cones, broader at the base, to break down or remove the hard coverings of grains. In the climbing frugivorous cockatoos, parrots, and maccaws, the bills are instruments of very great power, to break the hard shelly coverings of the larger seeds. The bills of the rapacious birds, of the eagles and the vultures, and the hawks and the owls, are strong, short, compressed, arched, curved at the point, dense in their texture, and with sharp cutting edges, to seize and tear and cut the flesh of living prey.

The tongue of birds is as variable in form as their bills or their food. In the woodpeckers it is long and filiform, as that of an ant-eater, and has the cornua of the os hyoides extended in a flexible and cartilaginous condition, backwards and upwards over the occipital bone and the upper part of the cranium, to allow the extensive and rapid motions of this organ in seizing in-

sects. It is short and fleshy in the struthious birds; arrow-shaped in the gallinacea; long, broad, muscular, and covered with large, sharp, horny, recurved spines in the swans; short, rounded, fleshy, human-like, and highly flexible, in the garrulous cockatoos and parrots; but the body and cornua of the os hyoides are almost always long, slender, and flexible.

From the bills of the birds being their only hands for all prehensile purposes, and from the various uses to which those instruments are applied, they could not be covered externally with fleshy and sensible lips, like the jaws and teeth of quadrupeds. The ruffs and the snipes and the ibises, and all the long-legged, long-billed birds, would be unable to thrust their jaws into the sand, and the earth, and the hard gravel, in pursuit of insects or grains, if they were covered over with soft and sensible, fleshy and cutaneous, parts like the face of mammalia. The only teeth developed in birds are thin, horny laminæ, disposed along the sides of the bills, as you see in the mallard and some other aquatic birds, and as we see in the horny maxillary plates of the whalebone whales; but in the earliest condition of the jaws of many birds, it is found that those horny bills begin their development by a series of detached tubercles, each provided with its pulp, its nerve, and its vessels, like the true calcareous teeth of other classes.

As the food of birds is not masticated in the mouth, and is not retained for any time in that cavity, there is little necessity for large salivary glands, and little stimulus for their development, so that we find those glands, though numerous in birds, generally much smaller than in quadrupeds. There are generally four pairs of salivary glands developed in birds, situate under the sides of the tongue, under the rami of the lower-jaw, close to the base of the cornua of the os hyoides, and at the angles of the mouth. These pairs of salivary glands are of different sizes, and vary in their development very much in different birds, but are largest in the gallinaceous tribes, and the mouth is amply supplied with mucous glands. As in other classes of animals, the alimentary canal varies in its length and capacity, and in the form and development of its cavities, according to the kind of food, being long and capacious, with large glandular organs, in the phytophagous tribes, and the reverse in those which feed on animal food.

The uvula and epiglottis not being yet developed, there is still a very simple entrance to the œsophagus. The œsophagus is wide, muscular, and of great length, corresponding with the great length of the neck in birds. In the course of the œsophagus, about its middle, before it reaches near to the two anchylosed clavicles, we observe generally an enlargement or crop, which is a cavity remarkable for its position in this class, and varies much in its size, form, and structure, according to the kind of food. In most of the gallinaceous birds (*Fig.* 163), we observe

Fig. 163

that in the course of the œsophagus (*Fig.* 163, *a*), at some distance above the two clavicles, it suddenly sends forwards a pouch or crop (*Fig.* 163, *b*), with a comparatively narrow opening, and extending outwards or forwards at right angles to the general course of the œsophagus. The mucous surface of the œsophagus is generally smooth and even. This is the most isolated form of the crop which is presented by the gallinacea. You see it here divided in front, so as to form two lateral sacs in the *pigeon*; and in most of the gallinaceous birds it extends out as a round globular sac, as we see it in this *peacock*, in this *turkey*, and in this *domestic cock*. This first pouch, or crop, is of a glandular and secreting nature, and, like the paunch of the ruminantia, is a first or general receptacle for unmasticated food. It has numerous minute glandular cæca or follicles, placed between the mucous and the muscular coats, which appear to enlarge at the time these birds are rearing their young. These little glandular cæca, continued obliquely outwards from the mucous lining, pour into the crop a milky secretion, which is particularly abundant in the pigeon when that bird feeds its young, and this milky fluid is the only food they receive for the first two or three days after being hatched; the grains which have thus been moistened, softened, and partially digested in this crop, are brought up again into the mouth and given to the young birds

when further advanced. This crop you observe in the diurnal rapacious birds to have a very different form. It there constitutes a general enlargement of the whole lower part of the œsophagus; this general enlargement of the œsophagus is very capacious in the eagles and in most of the diurnal rapacious birds. Into this great sac, which is placed in the lower part of the neck, and is contracted just above the two clavicles, they convey often their entire prey—the smaller quadrupeds,—with all their hair, claws, bones, teeth, and other hard parts that are afterwards to be thrown out in a mass from the crop, and not allowed to pass down through the alimentary canal. It is suddenly contracted in those rapacious birds, just before it passes into the opening between the two clavicles, or the division of the os furcatum. Sometimes this crop appears merely as a general enlargement or dilatation of the œsophagus itself, without any apparent constriction; and in those cases the crop is entirely wanting, as in many of the long-necked grallatores, and the long-necked struthious birds.

The second stomach is the proper glandular stomach (*Fig.* 163, *c*), the one that is placed immediately within the trunk of the body and below the clavicles—*the ventriculus succenturiatus*. That smaller stomach is observed to have, generally, upon each side, a number, which varies according to the kind of food, of pretty long glandular cæca, with their orifices directed downwards, that are situate between the mucous and the muscular coats of this second or glandular stomach. Those cæca are sometimes only in front, and sometimes all around the stomach, and they pour out a copious secretion to assist in the digestion of the food, on account of the imperfect or deficient glandular secretions of the gizzard itself, and they are always most developed in gramnivorous, and least in carnivorous birds. This ventriculus succenturiatus, or infundibulum, you observe in this wild swan, thick and highly vascular in its parietes, forming a considerable enlargement, and situate immediately above the strong muscular gizzard; it is most glandular and capacious in the phytophagous tribes of birds.

The gizzard (*Fig.* 163, *e*) is remarkably constant in its occurrence throughout the class of birds, although in the extent of development of its muscular coat it varies remarkably, according to the difference in the kind of food. In the gallinaceous birds the digastric muscles, with their white silvery shining tendons, on the two sides of the gizzard are very powerful, thick, and strong, and we observe this in many of the gramnivorous and the aquatic birds. In the rapacious birds, however, the crop, the ventriculus succenturiatus, and the gizzard itself, have all comparatively thin, membranous, and highly extensible parietes. In these thin membranous parietes, however, of the gizzard in the rapacious birds, you can distinctly see, on looking through it, as in this *sea-eagle*, or osprey, that there is the usual tendon disposed in the centre on each side, and that delicate muscular fibres radiate to the circumference from this central tendon, as in the more muscular gizzards of gallinaceous birds. This gizzard constitutes the third consecutive digestive cavity or stomach of birds. It is, when strong and muscular in its parietes, lined internally with a very dense, tough, coriaceous, thick, epidermic coat, to protect it from laceration, and to enable it to act with effect upon its contents. Into this cavity are conveyed the pebbles and gravel, which serve the gramnivorous birds as organs of mastication, from the hardness of their food, and their masticating organs being so imperfect in the mouth; so that if you deprive those gallinaceous birds of their pebbles, you might as well deprive them of their food, or deprive a ruminating quadruped of all its teeth; they will languish and starve in both cases. When the muscular walls of the gizzard are thin and feeble, the coriaceous lining is also thin, no stones are used, and the animal food is then digested by the solvent power of the secretions, and by the heat and movements of the canal.

Now the pyloric extremity (*Fig.* 163, *f*) of this muscular gizzard, which is always placed near to its cardiac orifice, so as to make this gizzard like a closed bag, open only above, is not provided with a sphincter muscle, as we see placed in that situation in man and quadrupeds; but being free and wide, it allows the food that is conveyed into it, pounded, ground, mixed up with the secretions, and partially digested in the stomachs above, to pass in small successive portions into the duodenum; for the interior of this strong masticating instrument, the gizzard, presents a comparatively small cavity which is chiefly occupied by stones, and hence the necessity of other stomachs, such as we see in the gallinaceous birds, being placed somewhere between this small gizzard and the mouth. The coarse vegetable food capable of being contained within the gizzard, would not be sufficient for the maintenance and growth of such large fleshy heavy birds. The first œsophageal stomach or crop, then, corresponds with the paunch, which is as necessary to the existence of ruminating quadrupeds, and with the cheek-pouches in many rodentia and

quadrumana, and all these preliminary sacs or receptacles in animals for the undigested newly-obtained food serve the same ends.

The intestinal canal of birds is still shorter than that of the mammalia, and has its different parts and divisions more distinct than in the inferior classes. The turns of the duodenum on the right side, embrace the conglomerate and lobed pancreas, which generally sends its secretion by two or more ducts, alternating with those separate ducts from the liver and from the gall-bladder, into the commencement or the first turn of this part of the intestine. Although still destitute of regular valvulæ conniventes, which are confined to the highest of the mammalia, the mucous coat of the intestine is in a high degree villous, and is often marked by transverse or longitudinal rugæ. The single, lengthened, and dark-coloured spleen, is attached near to the left side of the glandular stomach; and the bilobed liver has generally a free gall-bladder under its right lobe.

We can generally see in young birds a remnant of the original entrance of the yolk-bag, liken small cæcum (*Fig.* 163, *m*), on the anterior portion of the small intestine, and it often remains through life in wading and water birds. At the commencement of the colon, which is generally not wide nor sacculated, we observe in most birds two cæca (*Fig.* 163, *g h*) of various lengths, extending upwards, and connected with the sides of the small intestine. Those two *cæca-coli*, when they are of considerable size, as is the case with most of the gallinaceous and swimming birds, commence each by a narrow orifice (*Fig.* 163, *h*), continue narrow for some distance, and then enlarge each into a lengthened wide pouch (*Fig.* 163, *g*). Those two cæca-coli you perceive to be of enormous size in this *turkey* and in this *peacock*. The small intestine is here seen running down between them, attached by a mesentery, to terminate in the comparatively short and narrow colon (*Fig.* 163, *h l*). Where the small intestine enters the colon, you observe those two large membranous pouches in the peacock ten times the size of the small intestine between them, and rising up to an extent of fifteen or sixteen inches, with a diameter of nearly three inches. In the aquatic birds, as in the wild swans, you perceive they are still of great length but narrower, particularly at their commencement. Oken thought them analogous to a urinary bladder; but they occur also in some mammalia which have the ordinary urinary bladder. The cæca-coli of the ostrich have a spiral fold extending into them, and several folds of the mucous coat are seen in the upper part of the colon itself. Those cæca are least developed in the rapacious birds, where we sometimes can perceive only very small rudiments of them upon each side of the commencement of the colon, sometimes not half an inch in length, and in some of the climbing birds and others no trace of them is seen. Only one of them is seen in the herons. It is not a structure peculiar to birds, because we see that structure of a double cæcum on the colon in some of the mammalia, as in the *hyrax*, and in some of the edentulous and rodent animals; so that, as we observed with regard to the crop, the ventriculus succenturiatus, and the gizzard, these structures are not peculiar to the class of birds. We have seen the gizzard already among the insects and the gasteropods; in the *bulla lignaria*, for instance, that structure is seen of the stomach, consisting of strong muscular parietes, presenting upon each side very dense cartilaginous, almost osseous, plates, between which the hard testaceous food is ground. So we have seen a distinct muscular gizzard with coriaceous lining in most of the cephalopods, and nearly as strong in many of the fishes. So again we see in the crocodiles a strong muscular gizzard, and in the ant-eaters among the mammalia. It is not a structure which is more peculiar to birds than their crop or their glandular stomach. With regard to the crop, you have seen it common among the invertebrated animals up to the cephalopods, and the glandular apparatus above the gizzard, forming the ventriculus succenturiatus, you see thesame cardiac glandular sacs in the beaver, wombat, and other mammalia.

At the lower extremity of the alimentary canal in birds, we observe a *cloaca* (*Fig.* 164) or general receptacle for the

Fig. 164

opening of the single developed pervious oviduct upon the left side (*Fig.* 164, *g**), and the impervious rudiment of the right oviduct (*Fig.* 164, *h*) in the female, for

the terminations of the two spermatic vessels of the male, for the lodgement of the male organ of intromission, where it is present, as in the ostrich, for the termination of the intestinal canal, for the two passages of the urine or the ureters, and for the opening of the *bursa Fabricii*. This cloaca in birds is most developed in the ostriches (*Fig.* 164). The position of all those openings you can observe in several of the magnified figures before you, representing the cloacæ of various birds. On looking at them from before, you see in this female ostrich the rectum (*Fig.* 164, *a*) passing down and forming at its lower part the slightly enlarged portion termed the rectal vestibule (*Fig.* 164, *b*), opening into the upper and back part of the cloaca, as in this figure of the cloaca of the condor vulture. You observe upon either side of the cloaca, although considerably lower than the termination of the rectum, the opening of the two ureters, in two prominent papillæ. Externally, or laterally with regard to the opening of the two ureters in the cloaca, and nearly on the same level, you observe upon each side in the female the opening of the oviducts; the one upon the left side is the large, wide, fully developed oviduct usual on this side in the class of birds; the one upon the right side is the atrophiated or obliterated oviduct, stopt in its development at a very early period. In the middle, more near to the lower orifice of the cloaca of this female condor, is situate the passage on the median line called the *bursa* of Fabricius, considered as the analogue of Cowper's glands in mammalia, from opening into the urethro-sexual canal, and not into any part of the intestine. In this female ostrich (*Fig.* 164) you observe the lower part of the rectum (*Fig.* 164, *a*) passing down to the rectal vestibule (*Fig.* 164, *b*), which vestibule of the rectum is here protruded into a much larger oval cavity (*Fig.* 164, *c*), which is the urinary bladder of the ostrich, and the analogue of that cavity in quadrupeds. The rectal vestibule is capable, when distended with feculent matter, of being protruded completely through the urinary bladder (*Fig.* 164, *c*), and of passing even through a small compartment (*Fig.* 164, *d*) below it, which receives the terminations (*Fig.* 164, *f* f**) of the two ureters (*Fig.* 164, *f f*) and of the two oviducts, or of the two spermatic vessels in the male; this inferior portion of the cloaca has been called the urethro-sexual canal (*Fig.* 164, *d*); it corresponds with the urethra of the mammalia, and into this part the *bursa Fabricii* opens when it is present. It is here a very short canal, which you observe leads from this rudimentary urinary bladder of the ostrich, outwards, to the most exterior portion or the preputial cavity (*Fig.* 164, *e*), the one beyond the urethro-sexual canal (*Fig.* 164, *d*), in which the organs of excitement are placed, the clitoris (*Fig.* 164, *k*) in the female, and its analogue, the penis, in the male. This cloacal urinary bladder, so much developed in the ostrich, is the same part of the intestine which develops the urinary bladder and its continuation, the allantois, in quadrupeds and in man.

In the *mammalia*, as in birds, all parts of the digestive apparatus present indications of a higher development than is found in the cold-blooded vertebrata, or in the invertebrated tribes, and we observe numerous interesting varieties in every part, connected intimately with the living habits and instincts and the peculiarities of internal structure or external conformation which characterize the subordinate groups of this great and elevated class.

No system of the economy indeed is more immediately connected with the individual forms of all the separate parts of the body, and with the various instincts and the entire organization of quadrupeds, than their digestive organs. According as these first instruments of digestion for the assimilation of foreign matter to the likeness of their own body are formed, must the kind of food be on which the quadruped is to subsist; and so must also be formed all the different instruments for perceiving, pursuing, seizing, holding, and subdividing the food. Therefore the various modifications of form presented by the alimentary canal obviously influence the forms of the teeth, the jaws, and their articulations, the forms and articulations of the extremities, especially of the hands and feet, and indeed of the whole skeleton, and of the whole muscular system for the motions of the various parts of the skeleton; the nervous system also, which must correspond in its development with the wants and instincts, and the whole intellectual as well as the physical relations, of these animals, and the organs of the senses, which must perceive and distinguish their proper food, whether it be in the air or in the water or concealed in dark recesses of the earth. But as the glandular organs must afford the solvent materials to assist in the process of digestion, these must be most developed and most active where most required by the coarseness of the food. The circulating system, which affords the nutriment and materials to these glands, the respiratory system, which oxygenates and renews the lost powers of the circulating fluid, and gives energy to

the muscular fibre, and indeed every system in the economy, must be more or less influenced by the extent of development and the condition of the digestive organs. The forms of the locomotive organs are less immediately related to the food than those of the prehensile instruments, but those of mastication and deglutition are still more related than these; so that the forms of the molar teeth, the principal instruments of mastication, afford important indications of the kind of food and digestive apparatus, and of the whole structure and living habits of mammiferous animals.

The long moveable fleshy lips of herbivorous quadrupeds serve them as hands to collect and crop their vegetable food. The short-necked heavy-headed elephant collects it from the branches of trees by its lengthened nose or proboscis, which it likewise extends downwards to draw water from the brook to throw into its mouth, although the young animal is suckled by the mouth. The long-necked slender-headed giraffe twines its long flexible narrow tongue round the green foliage of lofty trees to bring it within reach of the lips and the teeth. The rhinoceros does the same with its long tapering thumb-like extension from the middle of the upper lip. The toothless bird-muzzled ant-eaters extend their long vermiform lubricated tongue to collect their unsuspecting prey. But the clavicled rodentia, like the quadrumana and man, collect and hold their food with their hands. This food we often find conveyed in the rodentia into cheek-pouches, as in the simiæ of the old continent and in some of the cheiroptera, and we see the same sacs in the ornithorhyncus.

The numerous mucous glands disposed along the sides of the mouth assist in softening the food in this part of its course. We saw already how the teeth vary in their forms and structure, according to the nature of the substances they are designed to act upon. In most of the herbivorous quadrupeds we see, in addition to the interior hollow osseous part of the teeth and the crystalline enamel which covers them, as we have seen in the inferior classes, an exterior enveloping *crusta petrosa*, which consolidates and unites the component parts of their large, broad, and complicated teeth. The food, reduced by these dense instruments placed in deep alveoli in single rows along the jaws, is mixed with the secretions of the parotid, the submaxillary, and the sublingual salivary glands, which are largest in the herbivorous animals, that retain the food long in the mouth during their prolonged mastication, and are least in the carnivorous tribes, where the food is more quickly divided and swallowed, and in the aquatic mammalia, where the thin secretion of these glands is less required in the mouth. It passes, thus moistened and reduced, into a wide pharynx, and thence into a long cylindrical œsophagus, without any such dilatation in its course as we have often seen it present in inferior classes. The œsophagus is wide and dilatable in the carnivorous quadrupeds, where the food is often swallowed in masses, and narrow and muscular in the herbivorous species, where the food is more completely subdivided, masticated, and softened. Although there is great uniformity in the general plan of the alimentary canal of this class, it presents numerous interesting diversities in the forms of its separate parts in the different tribes.

In proportion to the imperfect nutritious character of the animal's food must this alimentary canal be, in the whole, lengthened, complicated, and capacious, so as to receive a large quantity and to retain that food which contains but little nutritious matter; and so must it be short and small in carnivorous animals, to allow that nutritious and quickly decomposing matter to pass through it. The strong muscular œsophagus, with its external longitudinal and its internal transverse layer of muscular fibres, sometimes passes much beyond the diaphragm into the cavity of the abdomen. Spiral folds are sometimes observed at the lower part of the œsophagus, but MECKEL and others have never found a spiral valve in the cardia of the horse. As the alimentary canal is shortest, and most simple in its form, in the carnivorous mammalia, so we find in them often the stomach without a trace either of subdivision or of a cæcal portion. The cardiac fundus, however, increases to a cæcum, the stomach becomes contracted in its middle, so as almost to form two cavities, folds extend in others into its interior so as to form several partial divisions, and at length we find its cavity divided in ruminantia and cetacea into numerous distinct sacs having different structures and functions. These differences of complexity in the stomach have generally a relation to the greater or less digestibility, and the nutritious quality, of the food natural to the animal. We can often perceive obvious differences in the structure and functions of the cavities into which the stomach is divided, and even their several uses and the necessity for their development, but in many others we can assign no reasons for the particular forms which the stomach or its cavities have assumed, and the same is the case with the enlargements developed on the intestine below the stomach.

Among the most complex forms of the alimentary canal of mammalia are probably those forms of the stomach which present themselves among the cetacea, where the œsophagus is generally very short and wide, as in fishes. In these animals we frequently find the œsophagus leading to a long bottle-shaped cavity, and this succeeded by several smaller cavities of the stomach, placed transversely from left to right, and those cavities defined by very narrow constrictions, and even marked internally with a different form of the mucous membrane. Thus we observe a succession of cavities in the porpoise, where the first sac of the stomach is large, long, and capacious, corresponding with the wide and short and plicated œsophagus, and where there is even another sac on the duodenum. Perhaps in those cetaceous animals this subdivided form of the stomach corresponds with the generally low degree of organization of the food on which they subsist, as all kinds of fishes and lower marine animals, and it agrees also with the imperfect means of subdividing and salivating their food in the mouth, their teeth being merely prehensile organs, and their salivary glands being often entirely deficient. There is little difference between the small and the large intestine, and the cæcum of the colon is generally entirely wanting, or very small in those cetaceous animals.

The ruminating quadrupeds have the masticating and salivary organs large, the œsophagus narrow and long, the stomach very complex, the alimentary canal long and capacious, and the cæcum of the colon of enormous size. In the ordinary ruminantia we observe four principal cavities of the stomach; the first a large capacious and partially subdivided paunch, the interior of which is lined with closely approximated small but lengthened villi; this and the two succeeding cavities are covered by a continuation of the cuticle, as you observe in the specimen of this complex stomach before you of the Indian *zebu*. This first large cavity receives the grass and other vegetable food, which is hurriedly taken in unmasticated, and conveyed directly from the mouth, to be here accumulated until the animal obtains a sufficient supply, when it generally reclines itself upon the grass, and begins the act of rumination. In rumination, small portions of this imperfectly digested and moistened food passes from the paunch into a much smaller second stomach, which is covered on its interior surface with processes of the mucous coat, forming little projecting polygonal cells, or honey-comb plicæ. From this second or reticulate stomach the boluses are seen to ascend through the œsophagus into the mouth; there they are leisurely masticated, after having been moistened in the second stomach and formed into a bolus. After the food has been completely masticated by the lateral motions of the lower jaw, and mixed with the secretions of the very large salivary glands, it passes down again through the same passage, and at the lower part of the œsophagus it now meets with two valvular prominent closed lips, by which it is directed to the third stomach towards the left. The stimulus is different now from what it was when the dry unmasticated food first passed down through the œsophagus. At first, those prominent muscular lips at the cardiac orifice of the stomach remained open; now they are closed and contracted by the impression of the new stimulus, and the food glides along their upper surface, aided by their being also shortened by contraction, into the third and smallest cavity of the stomach.

This third stomach, extended transversely, is provided with numerous longitudinal plicæ, running parallel to each other, and alternating, a small and a large plica being placed alternately beside each other all round, which extend all their free margins inwards from the whole circumference towards the centre of this third stomach. This foliated or third stomach in the ruminantia is but a very small stomach with regard to its internal capacity, yet it presents an immense surface, by means of its many plies and their villous covering. That mucous surface is still obviously covered by a continuation of the epidermis, as seen extending over the first and second stomachs.

From the third stomach this digested food passes into the fourth stomach, which is more capacious than the second or the third, but much less so than the first; it is the proper digestive stomach,—that portion which corresponds most in form and structure with the single stomach in carnivorous quadrupeds, lined with a very soft secreting mucous coat, which has numerous internal longitudinal plicæ, but is destitute apparently of all epidermic lining. That mucous coat, and its large internal longitudinal plicæ, you observe in this inverted specimen of the fourth stomach of the Indian zebu. This is the most ordinary and simple form of the stomach in the ruminantia.

In the camels and dromedaries the structure is more complicated by means of its numerous water-cells, and is similar to that which you observe in this large preparation of the stomach of the *lama* of

Peru (*Fig.* 165), which is now so often imported into this country. We observe here that the paunch is very capacious, occupying the whole of the left and fore part of the abdomen, partially subdivided, as

Fig. 165

usual, by large folds, which extend a considerable way into its interior, as in the horned ruminantia. But we see at the part of this large paunch which is next to the second stomach, numerous rows of large, quadrangular, deep cells; those cells are surrounded by muscular fibres, which are capable, by their contraction, of excluding the food of the paunch from the water cavities. Those are the water cavities which, by their opening, allow the contained pure water to mix in small successive portions with the food, and which we see in the lower part of the paunch, as well as in the second stomach, of the camel, the dromedary, and the lama, to suit them for carrying with them a large supply of pure water, and thus for inhabiting arid and sultry plains. The second stomach of this lama you will observe also to be provided over a great part of its surface with the same cellular structure. This second stomach first receives the water, directly from the œsophagus, that is taken in as drink. It apparently conveys a portion of it, after its own cells are filled, into the cells at the bottom of the first stomach, and it thus fills with pure water from the cavity of the second, all the cellular cavities of the first stomach. So that portions of this fluid, little by little, can be transmitted from the cells, either of the second or of the first stomach, to mingle with the food while it is digesting. The third stomach, the many plies, is small, and of a lengthened form, in the lama, and provided internally both with longitudinal and transverse folds of its mucous coat. The fourth stomach is of a remarkably lengthened form, appearing here like a long colon, puckered, and curved suddenly towards its right or pyloric extremity.

The fourth stomach, which is so much smaller than the paunch in the adult state of those ruminating quadrupeds, is the stomach that appears to be alone employed for the digestion of the food during the earliest period of existence, and during the suckling, and you will observe in this dried specimen of the ruminating stomach of a fœtus taken from the uterus, that the paunch is comparatively small; the second stomach, already beautifully marked with its internal honey-comb plicæ, is very small; the third stomach has its numerous parallel plicæ not yet detached from each other; but, being still in contact with each other, the edges of those agglutinated plicæ form the boundary of a continuous tube, leading from the œsophagus through the third directly into the fourth or true digestive stomach. This fourth stomach is very large, at this period, compared with the others, and the milk in suckling passes thus directly from the œsophagus into the fourth stomach, which is here larger even than the paunch, without passing into the first or the second, and without remaining in the third stomach. The milk, passing downwards from the œsophagus, arrives at the prominent, still closed, valvular lips; it glides along them to the third stomach; the third has not yet been distended so as to separate those plicæ, and it merely forms a tube through which the milk passes into the fourth stomach.

The intestinal canal of the ruminating quadrupeds is of great length, and has always the colon long and convoluted, and of great width compared with the small intestine. The alimentary canal is sometimes more than thirty times the length of the trunk of the body, as in the sheep. The small intestine is long, narrow, with a villous internal surface, thin parietes, and a short mesentery. The cæcum of the colon is long, wide, and, like the colon itself, is smooth internally, (not puckered and sacculated by longitudinal bands, as we find it in many other herbivorous quadrupeds,) and forms numerous small convolutions before it ends in the rectum. The liver is but little divided into lobes, and the gall-bladder is often wanting. The bilobate pancreas sends out a single duct, which sometimes enters the hepatic, as in the camel, where there is no gall-bladder.

We find the same kind of food, the same form of masticating apparatus, and the same great development of the salivary organs, in the pachyderma, as in the ruminating quadrupeds. In this pecari the salivary organs are even larger than in any of the ruminantia. In many of these pachyderma we still observe many complex forms which mark gradations in the complexness of the stomach, to the more simple forms of higher orders. It is often partially divided by plicæ that extend into its interior, as you observe in the America tapir, and in most of the hog tribe. The

stomach in these animals is divided almost into several distinct cavities; the muscular œsophagus enters the middle large cavity of the stomach, and has upon its left side a semilunar or crescentic portion which ends in two cæca. On its right side, its pyloric extremity, we observe, also, continuations of the mucous coat, inwards, that produce partial subdivision, internally; but here, as in other pachyderma, the same form of the mucous surface is observed to be continuous, and to present the same character over all those partially separated cavities. In the little *hyrax* (*Fig.* 166), we

Fig. 166

observe a remarkable form of the alimentary canal, the stomach is divided, by a narrow constriction, into two almost globular sacs, and the pyloric portion of the duodenum enlarges to form a third though much smaller sac. The large and small intestines of this animal are nearly of the same length. The small intestine terminates in a large irregular sac, which is the ordinary cæcum of the colon; below this single large cæcum, the colon itself enlarges, to form another sac of a more lengthened form. About the middle of its whole length the colon again suddenly enlarges to twice its ordinary diameter, and from this enlarged portion two small tapering cæca (*Fig.* 166, *d d*) are extended, as from the colon of most birds.

Among the marsupial quadrupeds we observe in the carnivorous dasyuri and insectivorous opossums, a very simple membranous form, but in the kangaroo a remarkably complex form of the stomach. The œsophagus enters in the adult kangaroo at about nine inches from the left extremity of this long convoluted stomach, a stomach convoluted, and puckered by longitudinal bands, like the long capacious colon of the pachydermatous mammalia. You observe that sacculated and convoluted form of the stomach, both in this specimen of the adult and in this of the young kangaroo. There is thus a considerable portion, to the extent of nine inches, of this stomach, in the form of a cæcum, on the left of the œsophagus, beyond the part into which the cardiac extremity of the œsophagus enters. This is a more complex form of the stomach than that even of this pecari, if we are to regard its complexness as arising from the number of internal partial partitions. The kangaroo, which is the only representative of the ruminantia in Australasia, is often observed to be capable of bringing up boluses of food, like a ruminating animal, from the stomach into the mouth, to be remasticated, and to convey that food again when completely masticated into this complex stomach. The intestine of the kangaroo is very long and convoluted; the cæcum of the colon is of great length and size. You observe in this of the adult kangaroo that there is a length of the cæcum of the colon, which is here of a curved and sigmoid form, of about fifteen inches, from the entrance of the small intestine into the colon.

The cæcum-coli of the wombat (*Fig.* 167, *b*) is short and wide, and has a remarkable, small, narrow appendix (*Fig.* 167), opening into its commencement, and formed like the appendix vermiformis of the human body. This vermiform appendix of the cæcum of the colon is seen also in the highest genera of the quadrumana, where the stomach and the whole of the alimentary canal approach the nearest to those of man. At the cardiac orifice of the stomach we observe in the wombat, as in the beaver, a distinct gastric gland, in the same relative situation as we saw the glandular infundibulum of birds, and in both these quadrupeds, of rodent habits, it is developed to this extent to assist in the digestion of the very coarse food on which they subsist. In the sloths, and, as shown by Otto, in the semnopitheci, the stomach is sacculated, and as we see to a greater extent in the kangaroo. The myrmecophaga, like the byrax, has a double cæcum formed on the colon, but here placed at the commencement of that part, and they are small, without valves, and with narrow contracted openings. These ant-eaters have also a muscular stomach like the gizzard of a bird, or a crocodile, to a compensate for their want of teeth.

Fig. 167

The highly nutritious food of the strong carnivorous mammalia requires a less capacious and less complicated alimentary apparatus than we find in many of the inferior orders. Their great muscular strength, their acute organs of sense, their strong prehensile weapons, and their high cerebral development, enable them to perceive, to obtain, and to subdivide, that kind of food which requires least assistance from digestive organs for its assimilation, and we find their salivary

glands small, their œsophagus wide, their stomach simple, small, and membranous, their intestine short and narrow, the colon small, and the cæcum-coli very short and narrow, or entirely wanting. The mustelæ and the plantigrade carnivora have no trace of the small cæcum-coli which we find in the other genera, nor of the usual valve of the colon. The deeply lobated liver of the carnivora is always provided with a moderate gall-bladder, which sends its duct into the duodenum, near to the pylorus. The stomach of the bats is, for the most part, like that of the quadrumana, a simple membranous cavity, with a small cæcal portion to the left of the cardia; but in the frugivorous pteropi, as in the semnopitheci, the stomach is a capacious lengthened sacculated cavity, like the colon of a herbivorous quadruped, as shown long since by CUVIER and MECKEL. The simpler form of the alimentary cavity which we find in the higher quadrumana, in the gibbons and orangs, is that also of man, but the stomach of the quadrumana is more short and rounded, and has its left cæcal portion more extended, than the human. Their intestine still wants the valvulæ conniventes. They have the same sacculated wide colon with its three short longitudinal bands, generally the same short and rounded form of the cæcum-coli, and the same vermiform glandular appendix of this cæcum in many of the highest genera, which we find in the human intestine. This vermiform appendix is the only cæcum we observe in the human fœtus, and it is the form which the adult cæcum presents in many of the inferior mammalia. Thus we observe that all the essential parts of the human digestive apparatus are gradually developed and acquire their characteristic forms in ascending through the various grades of the animal kingdom, but man and the monad, at the two extremes of this great series, are, alike, digestive sacs, moved to and fro in quest of matter suited to prolong individual existence and the race.

GEOLOGY,—the very name of which has been but a few years engrafted on our language,—shows us that the existence of the earth has not been limited to a few thousand years of man's existence. Our globe has been subject to vast physical revolutions, and the geologist has discovered in it the existence of a succession of monuments, the tombs of the ancient inhabitants of the earth, each of which may have required a thousand ages for its elaboration.—*Professor Sedgwick, of Cambridge.*

ANATOMY AND PHYSIOLOGY.

LECTURES

ILLUSTRATED BY THE

HUNTERIAN PREPARATIONS

IN THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS, LONDON.

Delivered at the College in 1833, *by*

SIR CHARLES BELL, K.G.H., F.R.S.

LECTURE XI.

ON THE ANATOMY OF EXPRESSION.

WE were considering, Gentlemen, at a former lecture, muscular fibre, and from considering pure fibre, we went on to speak of the muscle itself, and after reflecting on the manner in which fibres of muscles are constantly brought, through the influence of the nerves, to act as one organ, we proceeded to consider how the different muscles were combined together.

Now it appears as if something were wanting in anatomy here; that is to say, we rest satisfied with examining beautiful plates, with reading the beautiful descriptions of ALBINUS and others, relative to the origin and insertions of muscles, which certainly are most beautifully depicted and described; but the classification of these muscles we have not entered upon. To this subject, therefore, I claim your attention, in order to observe how the same engine, that is, the same muscle, by means of different combinations, exercises different powers, or lends itself, as it were, to the performance of different functions, so that the same muscle will either subject itself directly to the will, or will act by an impulse of which the mind takes no cognizance. In proceeding with this subject, I first wished to make it understood that there existed an important class of muscles which were influenced by the condition of the viscera of the body, perhaps not primarily, but in a secondary way, and that under the influence of passion the contents of the thorax were bound together and acted together as one organ. Having given you an instance in which, by sympathy, one part excited the whole into action, I then begged you to mark the sympathy existing between the exterior apparatus of muscles, and the internal or contained parts.

For this purpose I drew your attention to the characteristics of asthma, showing you how the condition of the lungs wrought, as it were, on the muscles of the

chest and arms, and I incidentally observed how those muscles, becoming at the time muscles of powerful respiration, required to be at rest as muscles of volition. I then touched upon the subject of a sort of hepatization of the lungs, and of inflammation of the windpipe, attended with the peculiar muscular symptom in question. Then I referred to both as denoting a relation between the heart and the lungs, and I also, as marking the sympathy of the external muscles with the internal parts, adverted to the condition, character, and symptoms, displayed in a man dying from hemorrhage, bleeding to death. I ventured also to show, with reference to matters of art, that as, when a man was struck with a mortal wound, there was no inclination, or no capacity, to rally in him, it would be wrong in a sculptor to attempt to preserve dignity of form in the human shape, instead of attending to the dictates of nature, and showing the inevitable distortion, as it were, of the muscular parts of a fatally-wounded man;—in short, that those fine remains of antiquity (which are proved, by having been permitted to come down to us uninjured, to be true to nature), instead, as might be supposed by incompetent critics, and as was declared by a great authority in matters of art, of being the result of defective anatomical knowledge, are the effects of a severe study of the human body when under high excitement, or perhaps high passion. The excellence of thus representing figures in ancient times was readily appreciated then, because the very first men, and the highest educated persons in the state, were frequent witnesses of powerful exertion, and often saw the muscles in action, swelling under strong excitement, thus being familiar with appearances of which we in modern times are almost ignorant.

Resuming the subject, then, the first thing to which I beg your attention is a single muscle, the platysma myoides, and I venture to say, that so long as this muscle is viewed by the student only as Albinus or Cowper, or any other authority upon the anatomy of this part, represents it on paper, he remains ignorant of its functions, and scarcely understands that it is anything more than a cutaneous muscle, which, in brutes, for example, is an aid for digging up insects and other food, whereas it is a powerful muscle both of respiration and circulation.

In a certain condition of the respiratory organs, the blood experiences great difficulty in descending from the head, and nature, by the position and action of this very muscle, guards the head, and prevents the congestion which would otherwise take place. It arises broad on the side of the chest, passes over the veins, the great and external jugulars, and passes up to the face. In difficult respiration, you will observe the shoulder raised and brought back again; with the clavicle is raised the sterno-cleido-mastoideus muscle, and at the moment the clavicle is raised, and the sterno-cleido-mastoideus muscle is heaved up, as it were, this muscle is in a state of relaxation, at which period all the great veins, which might with much propriety be called *sinuses*—the large veins of the neck—fill easily with the blood which is returning from the head. And, again, when the action comes to be the very reverse, and more especially when this muscle is brought into action, then the blood does not return from the head; it is prevented from returning, but the muscle presses out the blood into the heart, even against the power of respiration.

Thus I conceive that nature is bountiful and careful to this end, that in all natural postures of the body, the brain shall not sustain that injury which it often would do, if there were no particular provision against congestion of the vessels which convey the blood away from the brain. Accordingly, in powerful exertion, during a fit of coughing, or at any other time when the respiration is powerfully occupied, you will see that this muscle acts most beneficially; and you will further observe that in attacks of asthma, where a difficulty of respiration is frequent, where there are returns of pain and excitement greater each time, this muscle may, like all other muscles of the body, become proportionably strong and powerful, as it is oftener employed. There is, in fact, a drawing down of the angle of the mouth, and a prominent character, acquired in asthmatic persons by the action of this muscle.

Proceeding then with this subject as it is illustrated by the connexion existing between the lungs and the muscles clothing the chest, I would bid you recollect what you must often have seen. Call to your recollection the condition of an infant at the moment of its birth. Consider it as physiologists. You imagine that the placenta has a vesicular kind of operation. During the period of gestation there is no call upon the lungs of the fœtus, but no sooner does the uterus begin to contract, and the vessels of the uterus diminish, than the flow of blood to the placenta is lessened, its function is straitened as it were, and diminished, and if the child be not then expelled, it must die you know. Cut off from the function of the placenta, there is an immediate call on the function of the lungs—that is, there is an immediate call for the operation of all the power-

ful muscles of inspiration, both the proper muscles of inspiration and the accessory muscles of which I have been speaking. The sterno-cleido-mastoideus, the pectoralis major, the pectoralis minor, the trapezium, and the serratus major anticus, are all brought into action. This is the effect of a painful impression, and by a painful impression it is that we are brought into existence. Pain seems to be necessary for bringing the parts into action; pain seems necessary to excite the mind; pain, in fact, seems to be our companion and guard from the first moment of life to the end. What is the expression on the face of the child when it first comes into the world? Is it not that of pain? Is it not the same kind of expression that accompanies the face throughout life on all occasions in which painful affections are experienced, whether arising directly from the body, or circuitously from the operation of the mind and feelings? But the cry of the child at the instant of birth is only of precisely the same character, except that is a caricature, as is seen in the outline of the face on painful occasions through the whole of life; but the expression of pleasure, its very opposite, exists on the face at a period when you cannot expect that the mind is the source of that feeling. The smile of the infant is most frequently observed during sleep, and certainly therefore at a period so early, that you cannot for a moment imagine laughter to be connected with the mind, or to arise from a notion in the mind of something incongruous. There is hardly a proof in the infant of a mind, or of any of its powers or affections being as yet at all developed, and yet an expression of pleasure plays upon its face, and the mother and nurse forthwith contend on the matter, the mother conceiving that she sees in the child a sympathy with her own feelings of affection, while old nurse insists that the smile is only the effect of an internal convulsion. Now I am rather inclined to join with the old woman. The smile, so far from having any correspondence with an affectionate feeling, is merely the result of irritation; but at any rate it seems to imply that the muscles which move the features are all prepared to act, whenever the mind is ready to excite them. In short, the outward expression, both of pain and of pleasure, precedes the development of the mind, though we are apt to consider it as naturally and necessarily connected with mental feeling. When I spoke of the influence of the body on the mind, I said that some might imagine I was teaching doctrines that led to materialism. All, however, that I meant to enforce was this, that the mind and body are intimately joined, and in the instance before us we find the body in a condition to act before the mind is in a state to influence it.

As connected with our subject I may here remark that it is not easy to account for the smile. Experience will perhaps induce you to say that it arises rather from a relaxation of the levator anguli oris, than the action of its opponent. You can hardly restrain the relaxation of the muscles of the lips even when you most desire it, and often a burst of laughter *will* follow. Advance from the smile to the laugh, and thence to the laugh in which the laugher is obliged to hold his sides. Why does he so? Because at length the action of the external muscles has become so powerfully excited by the disposition to laugh, as to be actually painful, and the person endeavours to restrain himself by putting his hands to his loins, and holding down the muscles. But what does that act imply? Why, that the instruments or organs thus excited belong to *respiration*. This is the point, then, which I wished to demonstrate, viz., that the laugh and the smile (different degrees of the same expression) are governed by the muscles of respiration, those very muscles which I have endeavoured to class together as one organ.

I was about to state that the expression of fear or terror is the result of a compound condition of the body, arising partly from the direct effect of the mind on the features, and partly from a reflective influence, and our common feelings teach us that this powerful affection of the mind centres in the heart. I am not arguing on the side of those who imagine that the heart is actually the source of the passions. Some of the French physiologists argue that the very passion itself is seated there; it must, however, be seated in that organ which is the seat of the mind; for passion is expressive of a condition of the mind; but though a mental condition, it works its effects on the body, and we can have no difficulty in tracing out the heart itself as one of those parts of the body which it affects. Thence proceeding a little further we can detect the relation which exists between the heart and internal viscera and the external muscles. Thus, as you observe a man who is thoroughly terrified, you perfectly understand why he is intent on the object of terror, and the cause of his undecided and hesitating movements. But you may not, at the same time, understand the cause of the pallid lips, the pale countenance, the quivering throat, the incapacity of utterance, the difficulty of free expiration. All this cannot be understood by studying merely the direct influence of the mind on

the frame; but by adverting to an intermediate stage,—its influence on the heart itself,—we have no difficulty in explaining why respiration is disturbed, or the muscles of respiration are so agitated. And I would here observe that the expression of horror in the man, and the character of fear perceptible in infancy, are very much the same; or if you are not familiar with the condition of the child just as it draws breath at the first moment of life, take that which is next to it, and almost the same with it, I mean that of a man recovering from drowning. If you have ever had an opportunity of seeing a man dragged out of the water, and have seen him draw his breath for the first time, you must have noticed his exact similitude to the state of a child as it draws its first breath.

Before there is any return of the senses, there is the agitation of the chest, the action of the serratus muscle, the powerful pulling and dragging of all the muscles which are inserted into the shoulder and humerus, the action of the platysma muscle, the heaving of the sternum by the action of the sterno-cleido-mastoideus, while the nostrils are inflated, and you, perhaps, do not know the cause of all this to be the difficulty of the act of respiration. Endeavour to restore to him freedom of respiration and circulation, and you will see that the man is in an agony of mind, of horror, of alarm. The mention of this brings us near to the subject I have now in view, viz. the classification of the muscles.

I wish to notice the distinction of the muscles of the chest as muscles of respiration, and as muscles of volition. As medical observers, we shall do well to examine their different conditions. For example, in tetanus, in its most powerful condition, opisthotonos, you have a very singular subject for study. I mean the universal action and tension of all the muscles, although the patient is insensible. Suppose the case to be one in which a wound of the head is going on wrong, and there is suppuration of the brain. I have seen a man in a violent and fatal paroxysm, and as he died another began to be affected, and expired exactly in the same way; and as he died a third began to be affected, and he went precisely the same course. I could not, therefore, mistake the condition of these patients, and I was struck with their similarity. It is a state easily described to the anatomist; it consists in an universal action of the muscles of volition, particularly of the flexor muscles, so that the hands are clasped, the arms are bent, the muscles of the back are powerfully exerted, not naturally against their opponents, for the opponents also are in action, only that the most powerful muscles predominate, and cause a dragging; those at the back overdrag those of the abdomen, and sometimes the patient rests in the shape of an arch, upon his heel at one extremity, and upon his head at the other. In that condition the muscles of the jaw, the lips, and the eyelids, are in powerful action, and the eyes roll outwards; every muscle of volition is in action, and is rolling, as it were, from side to side, while the patient rests only upon the two extremities of the arch. Such is the expression of a man dying of opisthotonos from a wound of the head.

But we have a most marked distinction in another complaint, that of hydrophobia, where the patient is far from being insensible. I have witnessed it in a powerful man, of great and good sense, who was fully alive to his situation. He is at one moment perfectly calm, and we pass by him; the next he is in convulsions,—he rises from the bed, tears along the room, catches at something in his way, leans on the bed-posts, and beseeches us to keep out of his way lest he should do us some harm. In all this there is a perfect volition, perfect command over the muscles; but on looking at those muscles we find in them delineations of the most perfect horror,—horror of the countenance, palpitation and expansion of the chest, which he is unable to relieve. All the muscles of the face are corrugated, and those of the neck are powerfully convulsed. In short, the expression is in all respects that of a person who is suffering intense agony of mind.

As I have ventured to deviate on the subject of the pictorial art once already, let me again observe that painters, in studying this subject, often go far wide of the truth, because they give loose to their imagination instead of confining themselves to nature. Even the best of painters, RAPHAEL, has done this, instead of painting like a man who was aware that his vision might be of more use to him than his fancy. If you go to Hampton Court to enjoy the richest treat in Europe, to examine the Cartoons of Raphael, you will see what I mean, and I will venture to name to you a particular instance of error in the painter, notwithstanding an excellent friend of mine has desired me not to presume to criticise those great master-pieces, but rather to learn to admire their beauties. In spite of the excellence of these cartoons, one who has studied the subject medically cannot approve of the manner in which the death of ANANIAS is depicted. Instead of representing convulsions, or an attack of a powerfully convulsive disease, by which the

mind has been overcome, the painter has twisted, the body in a most unnatural way; in such a way, indeed, as the body never was twisted, either in the agony of death or by any disease; and I cannot help saying that if he had represented Ananias in the convulsions of death, purely and naturally, the figure would have influenced every heart and every mind to a much greater degree than they are affected by the distortion of body which he has really exhibited.

But you may remark that I advert only to the violent passions in running through the anatomy of expression. I assure you, however, that the less powerful passions, grief, for example, lead to the same course of anatomical inferences. Figure to yourselves, for instance, a woman who has been exhausted with care, with alternate hope and alarm, having at last lost all comfort, and labouring under the most powerful influence of sorrow. Such a being would be sunk down in agony, would be indifferent to every object around her, would be pale, exsanguineous, and cold. Yet at short intervals there would arise the sob, the convulsive action of the muscles of the chest, tremor and action on the side of the neck, a swelling of the lip and an inflation of the nostrils, and, at last, the long-drawn sigh which indicates that the affection, though different from that of terror, is yet exciting the same parts of the frame, reaching to the heart, and to all those parts which belong to our present demonstration.

It would be useless to try to group together the muscles of the face, unless we had previously discovered the source of their action; but now, understanding that, we may with more advantage attend to the muscles themselves.

I will first present to you a skull, because it is necessary to understand the exact relation which exists between the teeth and jaws, and the muscles that cover them. You will remember that there is a certain character peculiar to the carnivorous animal, and a certain character peculiar to the gramnivorous. The latter does not need the canine teeth, so that there is an extraordinary combination of the muscles around the mouth, the orbicularis oris forming the fleshiness of the lips themselves. Then, without minutely demonstrating the parts, which would be very tedious to you at this moment, we may observe at once that the opponents of these muscles are coming off from every fixed point around, and converging to the lips; thus we have the levator labii superioris proprius, the levator anguli oris, the levator palpebræ superioris et alæ nasi, the zygoma, the buccinator, the trapezius, the pterygoideus, all converging to the same part, and their opponent is the orbicularis oris. If we turn to the tiger or the lion, we shall find a principle existing which will attend us through the whole of the subject, and which would carry us even further than we can venture to go. I allude to the correspondence which prevails between the soft parts externally, and the jaw and teeth. On dissecting the side of the lion's face, the whole mass of muscles is seen concentrated to one point. There is a muscle rising from every point of bone around, and all concentrating to this lip. And what is their action? To lift the lip and increase the power of the fang. Now the fang itself and the muscular lip are in due relation to the necessities of the animal, its mode of life and feeding, and its instinct; and the animal, when feeding, has a violent excitement of all the respiratory organs. You know well, if you have attended to the feeding of wild beasts, that there is a retraction of the lip, an unsheathing, as it were, of the fang, and a corresponding ferocity and blood-thirstiness of manner, and when we look to the same parts in man, we find that there is still something of the fleshiness of the part of the lip corresponding with the canine teeth. But how different are the muscles which draw upon the lip in the lion, from those in the milder carnivorous animal! In the horse the canine tooth is small; it only marks a certain relation; the lip does not cover it in the high manner which distinguishes the carnivorous animal, but there is a fleshy and moveable part of the lip covering the incisor teeth, and the muscles no longer draw the lip with the blood-thirstiness of character and the powerful action which we observe in carnivorous animals; for it feeds without passion, and these muscles are merely for feeding. High-bred horses will sometimes bite and tear with their teeth, but that is not their natural mode of protection. A horse which is in fear of another animal, will turn his heels to him, for in them is his protection, and he has, in fact, a small muscle of the eye which brings down one part of it, so that he may direct that organ behind him, a structure which is in correspondence with his powerful means of defending himself from danger.

Now when the muscles to which I have alluded in the lion are in action, they exhibit a certain conformation of the mouth in which violent passion is depicted, and I say that in all the violent passions, such as rage and revenge, there is this painful retraction of the lips. The Italian artists describe this bitterness in the mouth with peculiar force, and depict the object of it

as incapable of speech,—as having his heart transfixed with intense feeling, here again making the heart itself the source of the passion. I may illustrate this subject by a reference to a late great genius, COOKE. Mr. COOKE presented a character to the eye which we might almost say was unfortunate. His canine teeth were particularly prominent; he had a remarkable fleshiness of the lip which hung over those teeth, and a powerful action of the corresponding muscles. There was a bitterness of expression about his mouth, and an exposure of the teeth, that made one almost wish he did not belong to our species. But we shall find, notwithstanding, that man, however offensive, pitiful, small, or insignificant in body, may display so fine a mind, may exhibit so many of the higher qualities of the soul, and pour forth such a torrent of eloquence, as to induce us to confess that the mind can amply overcome or compensate for the imperfections of the body.

Speaking of the expression of rage in the human subject, I may remark, that our great authorities have conceived that when a person is hurt by an inanimate object, and feels a disposition to kick or strike it, there is, for a time, a belief that the inanimate object is alive, and capable of suffering punishment for the offence. I conceive that these great men were very wrong here. The explanation is to be found in the relation which we observe between the mind and the body. When passion rages in the mind, there is a disposition to conform the body to its expression, and the mind finds relief from the torture of the passion, if the body be permitted to express its existence. There is no doubt that if a man who feels the influence of passion composes his features and restrains himself from action, he will subdue the passion. If, on the contrary, he be removed from the presence of those whom he respects, and gives expression to his passion, his feeling will become uncontrollable. But even when the mind, by the exercise of a proper check, controls the passion, that very control powerfully influences the body. If, for instance, a man have a sword in his hand when he is excited, but resolves under a better resolution to throw it away, he still evinces the influence which the mind has on the body, although the mind was overcoming the effect the body would have produced. As a summary let me observe, that the passionate expression of the human face and carnivorous animals, has a strict relation with the heavy lip and canine teeth of the classes I have named.

Let us now, however, take the head of the horse. Observe the muscles which pass either to the nostrils, or over the lips. The muscle which in the carnivorous animal is used in uncasing the great fang, passes to the nostril in the horse, which has another powerful muscle for moving the cartilage of the nose, and which possesses a capacity for expanding the nostril. Now expansion of the nostrils is a mark of expansion of the lungs, for nature, in the perfection of her operations, endows the larynx, the lungs, and the thorax, with a capacity to correspond, so that the enlargement of the nostrils indicates an enlargement of the lungs, and denotes the strength or alarm of the whole animal.

But I was going to remark, that in all those timid animals which breathe through the nostrils, the expression of passion, instead of being in the lips, as in the carnivorous animals, is in the nostrils. Our painters fall into error when they represent an excited horse with an open mouth. The greatest energy of the animal is shown in the expansion of the nostril, through which alone he breathes. One of our late and greatest artists was once painting a horse, which he took a friend of mine to criticise. My friend said to him, "You are wrong in the head; the horse's mouth is open, and the breath coming out of it, which is not the case in nature." The painter at once saw that the animation portrayed in the animal was not of the right kind, although he said he had copied in that respect from some of the old painters, adding, "Say no more about it," and, taking up a brush, he rubbed it all out. The circumstance shows how much painters might improve themselves by studying the nature and anatomy of animals.

The nostrils of horses are finely provided with muscles, and are altogether a very pretty piece of organization. In the first place, the nose is the organ of smell. When a man breathes, part only sometimes of the stream of air passes through the nose. You can detect, during the common operation of breathing, when there is smoke or an offensive smell, but while you voluntarily exert the function of smelling, you do not breathe through the nose. No; there is an appropriate action of the nose for smelling itself, and the cartilages are pulled expressly into a condition for that office. While you draw the air through the nose up to the first pair of nerves, the first office of these muscles is that of forming the nostrils, and giving strength to the stream, as it is pushed past the olfactory nerve, and the nose becomes the seat of the most powerful expression. The horse, in a high degree of excitement, will exhibit its passion in the eye and nostrils; and even man, though he is so much

more highly constituted, and has the capacity of expressing by other means all the nobler passions, still possesses such a degree of mobility and expansibility in the nostrils, that the nose becomes in him a powerful organ of expression, for it is the intimate ally of respiration.

There is one remarkable circumstance which I have scarcely noticed. Furious animals, which defend themselves with open mouth, do not breathe through their nostrils, that is, their native mode of breathing is not through the nostrils, and, accordingly, the muscles of the nostrils are of insignificant extent and power. See how insignificant, for example, are the muscles which run towards the nostrils of the lion, compared with the combination of muscles that give expansion to the breathing tube in the horse. Now as man inclines (though he is between them) more towards the latter of these two extremes of animal structure, so do we find in his countenance a greater indication of excitement and passion in the action of the nostrils, than in the drawing up of the lip.

I now hurry on to the conclusion of the subject, and beg your attention to the occipito frontalis. The occipito frontalis, together with the orbicularis palpebrarum, and the corrugator supercilii, form a combination of muscles which act upon the eyebrows, drawing them down with a scowling aspect, knitting them together during violent excitement or passion, or throwing them up obliquely. The corrugator supercilii in the face of man, is the most chiefly indicative of the condition of his mind, and is most purely the index of human passion. Even while the greatest excitement is being shown by the inflation of the nostrils, or by the withdrawal of the lips, and the uncasing of the teeth, —even in that state where pure animal excitement and passion are displayed,—yet we find a knitting of the brow by the action of the corrugator supercilii.

I have been hastening through this subject, in order that we may be prepared to enter on one of a still more philosophical kind, yet one that is intimately connected with our profession—I mean the expression of the eye, and to that I will, with your permission, advert at the next lecture.

LECTURE XII.

SENSATION.—SENSATION IN THE EYE.

GENTLEMEN,—We are still engaged in studying the manner in which the muscles are grouped or associated together in the performance of different functions. Sometimes they act under the influence of the will, and sometimes they are altogether withdrawn from it, and are subject to another source of action. Some, at least, of them are involuntary in their movements at times, while at other times they comply with the most extraordinary minuteness with the direction of the will, so giving us at the same time most important knowledge—a knowledge which we draw from their action.

Between these conditions there is a great contrast, and therefore you may easily conceive the delicacy and difficulty of comprehending their modes of operating. How much have philosophers differed in their explanation of the powers of the eye, and how much do they still differ with regard to the mode in which those powers are exercised! They have looked upon it, I think, too much as an optical instrument. If an ignorant person were to see an astronomer using a telescope, and heard that the things which the astronomer described were facts well ascertained, he might well wonder that discoveries were made through that purely optical instrument, being ignorant of the parts attached to it,—the framework, the quadrant, the plumb-line, and the level, and all those adjunctives which are as necessary to assist the judgment of the observer as the optical tube itself. In the same way I conceive that philosophers of the very highest merit and character have done wrong when discussing the powers of the eye, in neglecting one department of science,—forgetting that they were speaking of an organ which was adapted to *life*,—despising too much the physiology of the eye,—overlooking, in short, the apparatus around the eye, which is sustained in its orbit by a most complex, but most perfect arrangement of other parts. We must not occupy our attention solely with the properties of the bottom of the eye. We must comprehend the sensations produced there by the assistance of the exterior apparatus.

But it would be vain to go *direct* to our object in such an inquiry. We should first ascertain whether we have a correct view of the voluntary motions of the muscles. We must endeavour, for example, to comprehend the property by which we *feel*, and by which we exercise the hand, or it will be vain to try to arrive at any conclusions regarding the operations of the eye. I hope you will assent to this, that in the exercise of the hand there are two properties at work,—first, the direct sensation produced upon the nerve (the touch), which would render us no service, however, were there not also, secondly, a power of motion in the hand, of which we have intelligence. I formerly de-

monstrated the power by which we stand, and you saw that this effect must be accomplished by a fine intelligence or comprehension of the action of the muscles, merely arranging the position of the body by a slight inclination of it, and adjusting all the muscles to that inclination. Conceive the nice adjustment there must be before a man can stand, or walk, or leap. Observe, too, how slowly we acquire the power to effect those actions, how very slow, and at first how imperfectly, a child acquires a knowledge of its own body; or, rather, a knowledge of its exterior. The child could not live at all, unless it had an instinctive and perfect sensation in the mouth; the instinct is perfect by which it sucks in the first instance, and long before it can move its hand towards an object and grasp it, it has the entire power of feeding. The moment an infant has anything in its hand, it seems to trust no sense but that of the mouth and tongue. It carries everything to the mouth. As surgeons, you know that if you operate on an infant a few days after its birth, although the child expresses passion, and pain is indicated by the expression, yet it does not know where the pain is situated. It cannot move its hand to the part that is hurt, and remove your scalpel. If you perform the operation for hare-lip upon a child newly born, or a few days old, you find no struggle to remove the instrument from the lip. It feels the pain, unconscious where. By these facts it is clear that even the knowledge of our own bodies is acquired slowly, and by experience only. If you defer the operation but a short time, but a few weeks, then the child tries to push away your hand. One might ask the assistance of philosophers in order to explain this, but I do not know that you will learn so much from philosophers as from your own observation as medical men. You recollect what BUFFON says on the subject. He is speaking of the first created man, and the manner in which his faculties were developed and perfected. In order to be more precise and striking, BUFFON does not describe what he presumes to have taken place, but says, "I shall introduce him to you and let him speak for himself." The man then begins by describing the first moments of his existence, his fulness of joy and pain, when he looked around and saw the fields and the waters, and the sky over head. By-and-by he walks, and strikes his head against a palm tree, not knowing as yet but that the tree was a part of himself. Now you see what a jumble BUFFON makes of his work. In the first place, the acquirement of a sense to enjoy all that is around, is a work of time and experience, and the pleasures experienced are those of association. And then as to the man's walking; why, we find on referring to the only proper object by means of which we can form any right conception of that action,—the infant and its slow operations,—how long it is, and how many fruitless experiments have to be made, before the power even of rising, much less of walking, can be achieved.

But it may be said, that the first man was born perfect in all his faculties. If so, he must have known that what he saw at a distance was not a part of himself, and he should not have been made by BUFFON to run against the palm tree. Those philosophers who describe the first man, are mightily afraid that we should conceive them to be speaking of Adam and Eve. No; they avoid that subject as one which is beyond their powers of mind, and say that they refer to some individual who has not been taught all that Adam and Eve are described as having known.

We now come to consider the motions of the eye. I believe that there are two kind of operation of the mind, and that we can judge of nothing by one only of its operations. There is the sensation at the bottom of the eye, and the sensation of the motion of the eye, and the same double operation takes place in all the motions of the body, especially in the extension and action of the arm and hand. Two things must be comprehended together before we possess a consciousness of anything that is external; nor, indeed, can there be any operation of the mind in which one sensation only is excited. But when there are two sensations to combine together, the operations of comprehension and judgment, it is then only that the mind becomes influenced, and can infer that the object contemplated is external to our own bodies. Now that the hand has these properties is clear. You well know, that when an arm or a leg is cut off, whatever touches the extremities of the nerve gives rise to a sensation of pain which appears to be in the limb itself, though it is removed. But there is something more than this to be considered, though it is not so well known, viz., that although the limb is removed, whenever the patient varies his position, he experiences not only an impression of the pain in the separated limb, but an idea of a change in its position. At one time, he says, the arm is lying beside him on the bed, and at another time that it is laid across his breast. He will feel it, as it were, in different situations. A susceptibility of those impressions, then, which correspond with the positions of a limb, remains equally with that of sensation.

Bringing this to bear upon the subject of the eye, I must first consider those motions of the eye which are directed by volition, as they stand with reference to the impression made by light upon the retina. We must recollect that there is a certain small spot in the retina, at the point directly opposite the pupil, in the very centre of the eye, which is excessively acute to sensation compared with the rest of the retina.

Now even this is sometimes denied, and by great authorities too. They conceive that the extreme sensibility at one point is the mere consequence of the concentration of the rays of light there, and that there is no greater degree of sensibility in a part of the retina, but that it is all equal to that spot. Suppose I was looking at a prospect southward, while the sun was up. So long as a beam from the sun entering the pupil could strike directly upon a part of the nerve which is so exquisitely sensible as the centre of the retina, could I see any part of the prospect? should I not be completely in the dark, which I am not when I look directly at the sun? If you look towards the sun through certain bodies, you are relieved from the force of its beams, so that you can see objects by the reflective rays of light, while the direct rays of the sun, shining upon a part of the retina, deprives it of sensibility. If you enter a chamber where your friend is reading by a lamp and his face is raised behind the lamp, if none but reflective rays strike upon his face, and come to your eye (which implies that a weaker impression is made on your eye by the light from his face, at the very moment the rays of light are entering your eye from the lamp), could you see the face of your friend distinctly? Certainly not. It is obvious, that whilst the sensibility of the retina generally is strong enough to let you catch a sight of whatever is passing before you, it is only when your eye is fixed directly in a line with an object that you possess a distinct image of it in the eye. The centre of the retina is the most sensible, because if all of that nerve were equally acute, the eye could not examine with greater distinctness any object on which it was centrally fixed, than those objects which surround the particular object of curiosity.

The next thing to be considered from this part of the nerve being sensible is, the circumstance that you are, in consequence of it, continually exercising the eye. It has been said, I think by BICHAT, that the organ of touch is peculiar in this respect; that whilst the other organs of sense receive their impression from without, there is, with regard to the sense of touch, always an impulse from within,—from the sensorium outwards. Now there is some delusion here. It is true that you do not merely feel a thing which is put in contact with your hand, but you make an effort to feel it, you push against it, you grasp it, you feel its size, or its hardness, or its elasticity. All this arises, of course, not from the mere exercise of sense with the extremity of your finger, but from the combination of your powers of action, and your sense of that action. There is something then going outwards, and at the same time an impression is received, and a combination of the two seems necessary to the perfection of the organs of touch. The same I hold to be the case with regard to the eye. When you enter a room, the moment that anything brought to you catches your eye, you direct the very centre of the nerve opposite to the object, and you are not satisfied until you do so. There is a certain craving to turn the eye in a direct line with it, and then you see it perfectly. But your eye does not remain on one point, for, insensibly to yourself, it rolls about. When you look at an individual, the eye is not fixed on one part of his body, but moves from point to point, measuring distances, and bringing itself acquainted with all the relations of the frame. You may easily convince yourself of this. If you wish to look at a particular figure in a landscape, you cannot at first do so, because there is this perpetual desire to move the eyes, and compare things in the picture. But at last you acquire the power of keeping the eye fixed upon perhaps the most brilliant point in the landscape. Now when you do obtain this command over the eye, everything else in the room vanishes from your sight,—becomes misty and disappears. What can the meaning of that be? It is the result of this law; that after looking at one object for a certain time, the nerve becomes exhausted, but the moment the eye is turned to an object of a different colour, relief is obtained, and the nerve is sensible to the new impression; thus, if I look on the centre of the paper before me for a length of time and then remove it to the carpet, a part of the carpet of the size of the paper looks dark coloured. Why? Because I have been receiving all the rays reflected from a light surface, and the bottom of the eye is in a certain degree exhausted, and on turning to the surrounding objects the impression from them is not so strong, wherefore I see the colours around more perfectly than in that portion of carpet which corresponded with the size of the paper.

Carry this a little farther, and fix your eye on a variety of articles all of which

are constantly directing their rays to some part of the retina. The nerve presently becomes exhausted, and a mist arises as it were before the eyes. But change the objects and then every part of the retina that before received a red ray, now has a green one. In this way, by the motion of the eye from point to point, a variety of impressions is made upon it, and a due degree of exercise is ensured to it. This is gained by the nerve being most sensible at the centre, and the necessity you are under to bring each part of the object, in succession, opposite to the centre so as to judge of the whole object.

A brother knight of mine denies all this stoutly, and certainly not in very measured language; but I apprehend that his extreme ingenuity and science have betrayed him here, from the circumstance that he has gone directly to the optical phenomenon of the eye for an explanation of its powers, without deigning to regard its living property at all. Thus, for example, he says that it is a property of the eye to know and judge of the different positions of an object, by the visible ray itself, and by the direction in which the ray is felt. He will not allow that there is any association of action, any double impression, any judgment formed by impressions, as to the property we possess of adjusting our muscles to the acts we are to perform. He says that it is not correct to do so. He says that if a man be placed on a stool and whirled round, he is perfectly aware of the changes momentarily made in his position, and makes no muscular effort while being so moved. This is certainly a great mistake. If a man riding in a carriage turns down a street to the right or left, must he not as he is swung round exert himself to keep his seat? So it is with every motion external to the body. There must be a relative position of the muscles, a new point of action, as it were, in all his muscles, at every change, to adapt them to that change, so that when a man is turned round he makes a constant effort to keep his place. The experiment of the stool does not imply an insensibility, or absence of action, in the muscles, and is not an evidence that we can judge of position independent of muscular action.

Let us again, generalizing as it were, observe the manner in which the eye of the infant is educated. A very young child cannot rivet its eye on the candle. There is a period of life at which no object can be accurately noticed by the eye, from a want of governance of its muscles; and yet you will find, at last, when you have put a pleasing object before an infant's eye, that as the eye wanderingly traces it, there is delight evidenced in all the little creature's body. Remove the object, and a vacancy comes over the face, an obvious distress, and a want of excitement. But, by-and-by, this being often repeated, the child can catch it easily, and then, instead of seizing it with the hand and transferring it to the mouth, as the chief organ of sensation, the child will be satisfied with grasping it and looking at it, but the latter is only acquired by a great deal of experience, and after many an abortive effort.

But while I venture to say that we always judge by means of two things, two points, two impressions, that there can be no judgment from one impression, I am bound to confess, and it makes me very doubtful of what I am endeavouring to impress upon you, that such men as PLAYFAIR and BREWSTER have formed different conclusions. The subject is surrounded with a thousand difficulties. I stated before that the great object of these lectures was to excite inquiry, and if you wish to pursue the subject, let me recommend to you the perusal of some papers by Mr. SHAW in *Brande's Journal of Science*, where you will find the subject admirably discussed: but I must not dwell upon it any longer.

Let me now draw your attention more particularly to the muscles of the eye, and as we are to take them comparatively, the muscles of the eye of the horse will serve our purpose as well as those of the human eye, and, indeed, much better.

Now when we look to the external muscular apparatus of the eye in that animal, I would say that it has two objects,—one to direct the eye as an organ of vision, to assist it, to perfect its movements, and another as a safeguard; for as the eye is so delicately formed, is so susceptible to impression, you may expect in the first instance that it shall be duly guarded; nor will you be disappointed.

Let me then observe to you that there are two classes of muscles moving the eyeball. First, those which are called *recti muscles*, and which are deemed to be voluntary muscles. They come from the bottom of the eye, pass in part over the eyeball, and are inserted at four points, distant from each other on the ball of the eye. We have nothing at present to do with those muscles, and will therefore attend to them afterwards; but there are two more muscles, not recti muscles, but which are called *obliqui*, from the manner of their insertion. The common opinion is, that the recti and obliqui are antagonists to each other, that they serve to sustain the eye in its place. Yet, in speaking of the muscles as opposed to each other, we should expect them to be each of the same

strength; but judging by the *mass* of muscle, you see that the preponderance is much in favour of the recti; they are four times the weight of the obliqui. There is a little discrepancy in that. It does not correspond with the common view. In the next place we have reason to observe, that when the muscles are antagonists to each other, the one should not be straight and the other oblique, because force is lost by an oblique direction, and velocity is gained. Why the opponents of the recti should be the obliqui I cannot tell, for if anything be certain on this part of the subject, it is that the oblique fibre produces rapid motion. Here there is another discrepancy. The recti run directly across, whereas the obliqui run obliquely. They are further distinguished in this, that the latter must pull through a greater space than the muscles which go direct. There is another difficulty:—If these muscles are to be considered antagonists, if the one is to be in action and the other relaxed, thus corresponding with the muscles of the arm, or of any other part where we see them properly arranged as flexors and extensors, here is at least no correspondence.

The next thing to notice is, that the recti are inserted at points diametrically opposite,—at the four cardinal points. Now the superior of these muscles raises the eyeball, turns the eye upwards, and the inferior of course downwards,—the internus towards the nose, by adduction, and the externus from the nose, by abduction; so that the eye moves in various directions by the action of individual muscles. Now suppose it is to be directed obliquely upwards and outwards; then these two muscles, the superior and the external, combine, and act at a disadvantage. But there are two of them to counteract the disadvantage, and so the eye is directed upwards, possessing equal power to direct it outwards. But then it is said that the obliqui muscles are useful in directing the eye diagonally. This I could believe if there were four muscles, but as there are only two, and as the eye is equally well directed towards every possible point of the circle, how is it that so much motion can be performed by two? Surely the recti muscles, acting individually, or combined, are equal to carry the eye round the circle commanding the whole field of vision.

These muscles, then, disagree in strength, number, and direction, and I performed this experiment to prove the fact. I cut the superior rectus muscle. I found no result, and was very much disappointed. I had miscalculated this powerful muscle, the retractor peculiar to quadrupeds, and I found it necessary to perform a more delicate experiment, which I did upon a monkey. At the moment that you cut across a little tendon, no effect is visible, because there is a spasm in the eye from the injury you have committed, and all the muscles are in action. Cutting this muscle across then in the rabbit, I found no effect, and my disappointment was considerable; but, by-and-by, when the creature was no longer frightened, I found that in feeding he could look down, but could not look up; he had no power of raising the eyes; no sooner had the violent spasms of the whole muscles subsided, than the opponent, the lower rectus, acted, and then, having lost its opponent, the upper rectus, the eyeball, could not be raised. Now seeing that it could not be raised by the volition of the animal, I desired to know if it could be raised otherwise, and, accordingly, upon touching the eye with a feather, the eye was turned up. You know very well that if you separate the eyelids, and touch the eye with anything, the eye is turned up, and so was it with the rabbit the moment it was touched with a feather, although the muscle was wanting. Here is another fact—viz. that the animal cannot direct the eye upwards by volition, without exerting the rectus superior, but the eye still possesses involuntary motion. By what means?—By the obliquus, by the muscle that comes from the margin of the orbit, and runs behind the ball to raise it. Here are two points gained; first, the rectus is a muscle which directs the eye voluntarily, and, secondly, the involuntary motion of the eye is the operation of the obliquus. We can now understand why these muscles are oblique. We have all along seen that rapidity of motion is increased by obliquity; this motion of the eye is intended to protect it, and therefore it is of the utmost consequence that the motion should be rapid.

Let us attend to the structure of the eyelids. When you are walking, and a fly touches the eye, the lid immediately closes. But it seems to be discovered, if I may so speak, that the motion should be more rapid than usual, and therefore, at the same moment that the cornea is covered by the eyelid, the cornea rolls upwards. This has been denied by the very gentleman I have mentioned, but it cannot be gainsayed by a medical man, because he sees the occurrence every day. I have shown it fifty times, when the eyelid has been paralysed, so as not to be capable of closing itself. I have said to the pupils in passing round, "Put your finger near the eye;" they have done so,

and immediately it has turned up. I remember the case of a girl who suffered much by a burn. The upper eyelid positively disappeared, the eyebrow was gone, both eyelids were lost in granulation, and a most extraordinary appearance presented itself. There were the two eyes, glaring, without any covering, and it is impossible to conceive the appearance presented. But I noticed that the eyes were for a time preserved by the motion upwards, for, whenever there was an irritation of the eyes, although there were no eyelids to close over them, the eyeball still possessed the power of going up, and the tears washed it, so as to preserve the transparency of the body.

To understand the great importance, however, of this subject, we had better refer to the horse, and see how nature protects vision in that animal. This will bring us to reflect upon the instrument in the horse's eye which is called the *haw*. You hear it called membrana nictitans. It is not like the membrana nictitans of the bird. It is cartilage convexly covered by the conjunctiva, and you will observe it correspond with the cornea, and having a glandular secretion about it. There is appended to it a mass of fat. Calling to mind the position of the eye in the horse, the haw is appended to elastic fat, and next to the fat is the retractor muscle, which is more powerful than all the muscles besides.

Whenever the eye is excited, there is an excitement of this muscle. The eyeball is retracted, the mass of fat is compressed, and by the compression of the mass of fat the haw passes over the eye, so that you never see anything like dirt or an extraneous body in the eye of the horse, unless a bit of grass gets entangled there. But in the most dry road a horse never suffers from dust as his driver does, and it is owing to this provision,—a third eyelid, as it were, which runs over the eye. At the moment the eye is turned inwards the haw passes over the eye, and having a glandular secretion, it removes whatever is offensive to the inner canthus, where it is conveyed out. We are not ourselves altogether without such an apparatus as this. The membrana semilunaris, which begins at the inner canthus of the eye, is something of the same kind. There is a viscid secretion, and when there is a mote in the eye, it is washed by the tears down to the corner. In the first place, there is a little fountain at the highest point above, and towards the outside; then the tears trickling over the surface of the eye, come to the channel betwixt the margins of the eye, for the margins do not close altogether; they close only at the edge, so that there is a triangular channel running inside. By this means the water flows from above towards the inside, and proceeds by this channel to the inner canthus, and then you find a little membrane of a triangular shape, which, when the eye looks towards the nose, is puckered up; but when you look outwards again, the puckering is withdrawn. When once the dust is floated down by the tears, and comes to this inner angle, the membrana semilunaris is admirably adapted to extract it.

Another beautiful thing in the human eye is the action of the little muscle called the *orbicularis oculi*. Now this muscle is divided into three parts. There is a powerful muscle, which is situated on the margin of the orbit; there are some fibres upon the eyelid; and you see others directly upon the margin of the cartilage. This muscle is only excited by the closing of the eye, when the eyeball is pushed back. Again, with regard to the semilunaris, if you take a pencil and make a point at the margin of the upper and lower eyelid of a friend, and then make him open and close his eyes, you will find that the upper mark moves upwards and downwards a little, but that the one below plays like a weaver's shuttle, goes backwards and forwards. This is the motion which is intended to rid the eye of whatever is offensive. It moves the little body, or whatever else, towards the inner canthus, so that we are not quite without protection in this respect, though not so perfectly formed there as the horse: and why? Because we have the assistance of the finger.

You may see when the eye of the horse is inflamed, because the haw is then prominently forward, and some farriers have been so ignorant on seeing inflammation of the eye, and conceiving that the haw was the cause of it, as to *cut out the haw*, which was the safeguard given by nature against irritating substances in that part!

As to the membrana nictitans, it is a finer apparatus still, but it is a most beautiful proof of the muscles being instruments of particular motion. There are two muscles at the back of the eye, which lie together, and the tendons of the one pass through the loop of the other. Both are abductors, and together draw the third eyelid over the eyeball of the bird.

I am well aware that I have not more than touched a most difficult subject, but I hope I have impressed the idea on my young friends, that they must not study the eye merely as an optical instrument. The judgment formed by the organ of vision, is not to be attributed entirely to

the exercise of the nerve of sense, but to an impression made upon the nerve and sensibility of the motion of the eye itself. Thus we must not regard the telescope as an optical instrument, but remember also the share in the results of astronomical observations, which belongs to the framework.

EMETICS OF COMMON SALT IN MALIGNANT CHOLERA.

To the Editor of THE LANCET.

SIR,—I have read with much interest the remarks on Cholera in the leading article of the last number of THE LANCET. Mr. Beaman's letter too, to which you refer, is one of great value to practitioners at the present moment. I am induced to send you the accompanying statement from the pen of my esteemed friend Dr. Pidduck, in consequence of the remarkable resemblance it bears to that of Mr. Beaman. Mr. B.'s known respectability would, of course, place him above all suspicion of unfair plagiarism, but I am anxious not only to do justice to my friend, whose unobtrusiveness is characteristic, but to give no small degree of confirmation to Mr. B.'s remarks, for which reason I have to request that you will allow Dr. Pidduck's statement a place in your Journal.

It may be well to say that Dr. Pidduck published his plan of treatment in August, 1832, in a letter addressed to the Editor of the *Medical Gazette*, and subsequently in a separate form* (as I now send it to you), for more extended circulation, and adapted to non-professional persons. Dr. Pidduck witnessed the disease on an extensive scale in the district of St. Giles, where he has long been known as an indefatigable attendant on the poor. His experience is decidedly against the use of stimulants in any form, and his success has been very considerable, the failures being almost uniformly in cases where stimulants had been previously administered.

I have not myself had sufficient experience of this plan of treatment to enable me to offer an opinion with a sufficient degrec of confidence, but if I should venture to pronounce favourably respecting any plan, from very limited *data*, it would be of this. Common salt, when administered in large quantities in solution, excites copious vomiting with great rapidity. Whether it has any effect in arresting that peculiar change which takes place in the blood, is matter for question, but it certainly answers all the objects that are sought to be gained by other emetics, and it does not irritate and inflame the gastric mucous membrane like mustard, nor does it depress the vital powers as tartarized antimony and other medicines of the same class. The subsequent treatment is judiciously directed to keep down secondary fever, which has sometimes proved fatal.

There is a cholera hospital in St. Giles's now open. I know that Dr. Pidduck two years ago failed in his efforts to induce the medical men there to give the salt plan a fair trial. This year I am informed, on authority which I cannot question, that of 15 cases received into the hospital 13 have died!! Where so fearful a mortality exists, it becomes a question how far a practitioner is justified in rejecting a plan of treatment which is not contrary to the dictates of common sense, and, much more, one which is confirmed by the experience of two such respectable practitioners as Dr. Pidduck and Mr. Beaman.

I have lately heard of a physician whose favourite mode of treatment is venesection and the exhibition of colchicum. In these days of Hahnemannian medicine, one is hardly astonished at any system of practice, however absurd. Surely few will be found to adopt this plan in preference to that which I have been advocating. I have the honour to be, Sir, your obedient servant,

R. B. TODD, M.D.

5, Hart-street, Bloomsbury,
August 25, 1834.

P.S. Since writing the above I have heard from my friend Mr. Griffith, of Belgrave-street, the particulars of a case of cholera, in which all the symptoms were unusually prominent. In consequence of Mr. Beaman's letter he was induced to try the salt plan, and met with complete success.

[**** From the printed paper accompanying the letter of Dr. Todd, we extract the following passages, for which only have we space in our present Number. The remaining recommendations in the paper relate chiefly to the production of warmth, and the administration of calomel

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* A similar communication was, we recollect, made to this Journal, both by the Central Board of Health (which had been put in possession of Dr. Pidduck's plan), and by Dr. P. himself, but its publication was prevented by the influx of matter relating to the cholera, then prevailing, which compelled us to exclude numerous plans of treatment that were forwarded to our office, the chief suggestion in them being before the public in correspondence already published.—ED. L.

pills, castor-oil draughts, and cordial and saline mixtures.—Ed. L.] :—

"*Treatment of Cholera.*

"One or two tablespoonfuls of *common kitchen salt*, dissolved in half a pint of warm water, is to be administered (in the spasmodic stage), and the patient's head is to be covered with the bedclothes, and on no account is he to be permitted to rise. One tablespoonful of common salt, in cold water, is to be repeated every hour, till copious vomiting of yellow bitter bile be produced, and a profuse perspiration breaks out. It has never been found necessary to repeat the salt and water more than three times. If the patient complains of thirst, let him drink moderately of thin gruel, soda water, or even cold water, which, instead of retarding, seems to promote free perspiration and the abundant discharge of bile, upon which his safety depends. * * *

"Under this plan of treatment, not a single case of spasmodic cholera under my care has proved fatal, excepting when ardent spirits or laudanum had been previously given, and the salt in consequence failed to produce bilious vomiting. * * *

"In persons of a full habit, *bleeding*, before the administration of salt, may be necessary; but no case of this kind has occurred in my practice.

"J. Pidduck, M.D.

"87, Great Russell Street.
August 15, 1832."

ADMINISTRATION OF

EMETICS IN MALIGNANT CHOLERA.

To the Editor of The Lancet.

Sir,—I perceive that, in a communication of Mr. Beaman, he recommends the saturated solution of salt in water in the treatment of cholera. This was the practice adopted at my suggestion by the medical gentlemen at Wick, and which I adopted myself in all the cases to which I was called, an account of which I published, with a tabular abstract of the cases and the mortality, &c. The object of my present communication is to submit some views of my own which do not exactly coincide with Mr. Beaman's, and to offer some remarks which probably Mr. B. will allow ultimately to be correct.

I was first induced to adopt the salt-water emetic, from having frequently used it, and found it successful in arresting the cold stage of the "intermitting paroxysm." The administration of the hot saturated solution of salt brought on the *hot* stage; but very often there was a transition directly from the *cold* to the *sweating* stage, immediately after the operation of the salt emetic, without passing through the intervening *hot* stage.

The indication in a paroxysm evidently is to arrest the existing stage by inducing the succeeding stage, which is the *natural crisis* to the next preceding. I was therefore agreeably surprised to discover that this kind of emetic not only arrested the cold stage, but in a great proportion of instances brought on the last—the sweating, the critical solution of the paroxysm—without passing through the hot. The object with me was to terminate the cold stage of cholera, and to bring on febrile reaction, as a better-understood and more manageable form of disease. In many instances the administration of the emetic put an end to the disease at once by inducing sweating; in others fever succeeded which went through its course.

Mr. Beaman attributes the efficacy to the vomiting. I do not; because vomiting induced by any other means *has not* the same effect. In my observations the *vomiting* was easy, no way violent, nor attended with any straining; and I also observed that the more violent the vomiting, either *natural* or *artificial*, the more severe the consecutive fever, the greater the congestion or inflammatory symptoms in the brain, and ultimately the more fatal the cases. A gentleman to whom I was introduced by Sir D. Barry, told me that he found tartar emetic eminently successful. This was administered so as to keep up a constant vomiting till death or convalescence. The spontaneous vomiting is abundant, and I cannot understand the object of increasing it by artificial agencies. The gentleman, however, allowed that the mortality in his practice was one in three, which he considered very moderate. On comparing it, however, with my abstract, I think it will be allowed that the practice is not very successful.

Of the five stages into which I have divided the disease, the salt emetic is applicable certainly to three, possibly to four, viz., the preliminary diarrhœa? the premonitory, the cold, and the collapsed stages. I have not used it in the diarrhœa, because I have found another method sufficiently successful; its effects in the premonitory and the cold stage are very beneficial,—for the detail I must refer to the pamphlet; in *collapse*, it, as well as everything else—every other means with which I am acquainted—fails, and I think it right to state this clearly, lest persons trying it in this stage, and finding it fail, might, from disappointment, abandon a useful remedy, and one which will gene-

rally answer their expectations in the other stages.

I shall conclude this paper by furnishing you with a brief abstract of the cases at Wick. The regular population of that town is about 8000. In the fishing season the population receives an influx raising it to between 30 and 40,000. This was the case in August, 1832, on my arrival there.

The total cases at Wick up to the period of my departure in December were, in my own practice, 353; in the practice of the resident practitioners, 88; total 441.

Total deaths 68 : 441 :: 1 : $6\frac{13}{68}$.

Of the fatal cases two were above 80 years of age, five above 70, seven between 60 and 70, and eleven between 50 and 60. From the abstract we may deduct the two above 80, and the five above 70, as worn-out constitutions, incapable of sustaining an attack of any disease, however mild its nature; we shall then have the fair average mortality thus:—Cases 441 − 7 = 434; deaths 68 − 7 = 61 : 434 :: 1 : $7\frac{7}{61}$, the fair average of mortality.

The above were cases of pure, confirmed, cholera, as described in my pamphlet and exclusive of from 1800 to 2000 cases of diarrhœa, which are not taken into the account.

These facts, corroborated by Mr. Beaman's observations, may perhaps induce medical practitioners to try, and report upon the efficacy of, this practice.

I am, Sir,
Your obedient servant,
Robert Venables.

17, Ely Place, Holborn,
August 23, 1834.

THE LANCET.

London, Saturday, Aug. 30, 1834.

The circumstances connected with the appointment of a Committee of Parliament, having for its object the institution of an inquiry into the state of medical education and practice in this country, were extraordinary, perplexing, promising, and exciting. Down to the very period when the motion of Mr. Warburton was brought forward in the House of Commons, the base hirelings of corruption, in the attempt to earn the wages of their infamy, were vociferous in contending that the "higher branches" of the profession maintained an unsullied reputation with the public, and shed, by the exercise of their genius, a brilliant lustre on the science of medicine in this country. In attainments, the luminaries of the Colleges of Physicians were represented as perfect, and it was only in the *system* which led to their elevation that there was aught which required alteration or improvement. If the road to elevation had been widened a little,—if it had been rendered slightly less restrictive or exclusive,—nothing more, according to such advocates, would have been wanting,—further extension of privilege would have been injurious to the interests of the profession. In conformity, however, with the principles of such worthless mock-reformers, the widening of the road ought not to be attended with a diminution of expense; the toll that was to be exacted on the improved collegiate halter-path was not to be lowered, because a lessening of expense in the procuration of medical honours and privileges would be "destructive to the medical character," by rendering the sought-for distinctions too easy of purchase!

This odious doctrine was not advanced until every art had been practised with a view to render it obnoxious to the attainment of those privileges which medical practitioners had a right to demand. The more insidious plea was previously urged, of making the profession "respectable" by adding to the items of every university medical curriculum. It had been insisted that the examinations for medical degrees should furnish more appropriate tests of the abilities of candidates than formerly, but at the same time it was most speciously and sophistically insinuated that, as *all* candidates could not be supposed to be gifted by nature with those capabilities which could enable

them to become fully conversant with the copious details of medical science, therefore the highest honours of the profession must be conferred on a *fee* only,—awarding, at the same time, to the less accomplished candidates, the mere right of exercising the functions of practitioners amongst the poorest portions of the community.

When the veil had been stripped from the impostors by whom the numerous statements and arguments of this description were published,—when it had been incontrovertibly proved that the medical title which is derivable from the right to practise,—that right acknowledging no other foundation than an acquaintance with medical science,—should be *uniform* throughout the empire, that was the time chosen by these agents of the corruptionists far contending that the *expenses* of medical education, the *cost* of medical degrees and licenses, should not be reduced to "too low a rate," lest it should produce such an influx of candidates as might lessen the respectability of the profession. On the subject of expense a silence during many years had been observed by those disinterested advocates of a "high intellectual standard of qualification," but at length, when falsehood and calumny could no longer stifle the expression of public opinion,—could no longer repress the universal acknowledgment that surgeons in general practice were, *qua* practitioners, better qualified than many of the most "dignified" of the tribe of Sir HENRY,—then was it insisted that the expense of medical education should be heightened, in order that a *money*-barrier might be established to effect that object which the knaves had for so many years falsely asserted could only be accomplished by the interposition of a check imposed on presumptuous ignorance.

If it was extraordinary that men of character, affecting on all occasions to be influenced in their conduct by a "high moral feeling," should patronise, and even invent, such practices as these, to deceive not only the public but the Legislature, it was equally perplexing and annoying to those members of the House of Commons who felt an interest in medical questions, and who were called upon, in the discharge of their important duties, to adopt such measures as would be best calculated to lead to an efficient investigation into the government of the medical colleges and companies. Had the subject been left to a free and open discussion in the pages of the medical journals, the majority of the profession would not have had one difficulty to encounter,—would not have been opposed by a single barrier of sufficient strength to retard their progress. Unfortunately, however, the chief of the secret bulletin-signers had still an opportunity of whispering into the ear of Royalty,—had still the advantage of bending his supple spine, and of exhibiting his fawning, courtly, smile in the presence of Prime Ministers and Lord Chancellors. He played his part industriously, and in *some* quarters he wheedled and cajoled with a degree of success which would have rendered his triumph complete, had it not been resisted by the energy, sagacity, ability, and integrity, of Mr. WARBURTON in the House of Commons. When we state that a "ROYAL COMMISSION" was *all but* appointed, and that the institution of such a tribunal by the Government would have necessarily led that Government to oppose the motion of Mr. WARBURTON in the Commons, the jeopardy in which the question of medical reform was momentarily placed, will be instantly understood and acknowledged. But the fact must not be concealed that Lord MELBOURNE, the now Premier, who was at that period the Home Secretary, stood firm to his promise made to the deputation from the petitioning licentiate-physicians. The

noble Viscount, with his manly and characteristic independence, insisted on the necessity of a full and an impartial inquiry, and was therefore decidedly in favour of allowing the investigation to be conducted by a Committee of the House Commons.

It is a fortunate circumstance for the profession that Sir HENRY HALFORD is acquainted with the character of the Premier, and not less so is the fact that the Premier is *thoroughly* acquainted with the character of the eel-backed President. But although this knowledge is reciprocal, the personal advantage to be derived from it will, we believe, be restricted to one party. There is a something monstrous in the supposition that the rights of a large body of men may at any time be whispered away by the slanderous misrepresentations of the toad-eating reptiles that habitually crawl in the purlieus of cabinets and palaces. Such an anomaly in civilization would not be considered possible, had not experience proved that it is practicable. Unhappily, in hundreds of instances which may be named, the interests of the many have been made to succumb to even the caprices of the few, and often has it been seen that institutions bearing high-sounding titles have been indebted for their existence to the ingenuity and cunning of those very men who had converted them into machines for plundering the public. It may be easily imagined, then, with what assiduity the views of the corruptionists were enforced in the highest quarters, in order to lead to the defeat of the motion of Mr. WARBURTON. The cause of justice however prevailed, and the misrepresentations which had been the cause of so much perplexity and excitement having been detected, the real, the exposed, weakness of the monopolists, the rottenness of their cause, the odious means sanctioned and adopted by them in the hope of perpetuating their detested system, cast over the appointment of the Committee of the House of Commons a gleam of hope and promise which, probably, it was not possible that any other combination of events could have produced.

The thirteenth day of March having been appointed by the Committee for commencing the examination of witnesses, it was inquired on all sides, "how the "Colleges would get out of the investiga-"tion,"—"in what manner they would en-"deavour to escape,"—"whether the Com-"mittee had power to enforce their orders "for the production of accounts and pa-"pers." The ruling authorities in our old receptacles of injustice reared their haughty heads, and affected to bid defiance to the threatening powers of the impending storm. "What cared *they* for Mr. WAR-"BURTON and his Committee,"—"what "cared they for the medical reformers,"—"the *law* had not been violated by them, "and therefore they had nought to fear," "—their charters, and the Acts by which "they had been confirmed, authorized the "decrees they had issued, and if," said they, "the law has been advantageous to "us, it has not been because we have per-"verted the law, but because the law has "been constructed so as to favour the "interests of the ruling authorities. In "acting upon that construction we have "taken advantage only of the precise "forms of the law; had we rendered it "equally beneficial to others, then indeed "should we have perverted those excel-"lent statutes which were so wisely framed "for protecting those persons with whom "were to be lodged the reins of col-"legiate government." In this insolent and domineering spirit did the heads of the medical colleges meet the parliamentary committee on Thursday the thirteenth of March, but the audacity which characterized their first appearance was of short duration. In several instances the

tone and bearing of insolence gave way to a feeling of humiliation, and in more than one person their absence was followed by all the more prominent indications of detected guilt.

At the time the Chairman took his seat, surrounded by the members of the Committee, the room was thronged with spectators, and it was curious to observe the *manner* of the entire assembly. There was a constrainedness of action,—a solemnity of character,—a fixedness of expression in every countenance, which intimated to the observer that the inquiry that was about to be instituted was one which involved questions of guilt and innocence, and that it could not terminate without inflicting a stain of everlasting disgrace on the moral reputation of men, who, from their rank in society, ought ever to share in that general respect which should belong to the elevated members of a liberal profession. There was much curiosity to ascertain who would be the first witness, or at any rate who would be the first individual "called," as it was soon found that Mr. WARBURTON was too acute a judge to begin with what might be properly designated *witnesses*. The tact exhibited in this excellent manœuvre of the Chairman, reminded us of a scene which we once observed at an otter hunt. The huntsman shrewdly allowed the lads by whom he was surrounded to amuse the high-bred pack by worrying some animal of much less importance than the tough-hided, hard-mouthed, iron-jawed beast which was the immediate object of the morning's diversion. This was a commencement; it set all parties on the move; the expectations were excited, the senses were sharpened, and the dogs were impassioned by the taste of blood,—not that the proceedings of the Committee bore any resemblance to this sanguinary rencontre, although it must be confessed that the committee-room, during the progress of the inquiry, was rendered the altar of many a moral immolation.

But to return from this digression, for the purpose of noticing and commending the tact and discretion of Mr. WARBURTON. FRANCIS HAWKINS was the first person called. What was he? The registrar of the College of Physicians. As it was determined to commence the inquiry with this institution, what course was so proper to pursue as that of calling on the registrar to furnish an account of all the documents, the rules, orders, by-laws, and regulations of that College,—to explain the cause of erasures, to account for omissions, and to clear away certain ambiguities—if they admitted of explanation—in the collegiate annals? Possessed of these documents and extorted expositions, Mr. WARBURTON was supplied with that thorough knowledge of the internal machinery of the institution, which enabled him to put to the President, and to the past and present censors, questions which elicited replies calculated to leave no doubt on the mind of any rational being as to the pernicious, disreputable, and dishonourable manner in which the College had been governed. FRANCIS HAWKINS, then, having been used as the stick, or marked guage, for measuring the depth of the slough, we pass over his examination, as it was quickly discovered that the sought-for information was not in the head of the examinee, but was lodged, for the most part, in the strong box of the College—kept there for safe custody, lest the licentiates should obtain a sight of those laws which they were bound to observe.

At last, forth came the ancient otter—splash into the very centre of the pool.

"You are President of the Royal College of Physicians?—I am.

"Besides the by-laws, is there any book of rules and orders of the College?—No. There are some memorials by which we are enabled to know the form of business."

Such was the second question and such the second answer. There was to be no straight-forward swimming, it appears. Every hole and creek that could be made available was to be sought for as a shelter from his pursuers. Observe! There was no book of "rules and orders," but there were some "*memorials*, which enabled them to know the form of business." Why, deuce take the otter-headed man, what were these prescriptive memoranda for regulating the proceedings of the College, if they constituted not the "rules" for those proceedings?

Questions continued.

"In the annals of the College, June 12th, 1812, there is a resolution said to be inserted in the 'Book of Rules and Standing Orders.' That would appear to imply that there are books of rules and standing orders?—I have a book in my possession, as President, by which I am informed of the cause of my duties."

"The book is for the governance of the President himself."

To be sure he had, but possibly it was not convenient to acknowledge that such a book existed, lest it might be demanded,

"You apprehend it is that book which is referred to in the entry of the 12th June, 1812?—Yes; that for the governance of the President himself."

Here, then, Sir HENRY distinctly states that the book is a sort of manual for regulating the conduct of the President, and that of the President only. Take especial notice, then, of the next question and answer.

"It appears that the resolution read is not only for the governance of the President himself, but also for the governance of the Fellows of the College?—I do not remember to have read that in the book to which I allude of the directions for the President's conduct."

Really we must place these replies in juxta-position.

"I do not remember to have read in that book the directions for the President's conduct."

At this early period of the examination, the Committee had become acquainted with their witness. This was a great point gained, and it was turned to good account as the examination proceeded.

"Have you ever had occasion to look into the origin of the by-laws of the College which restrict the admission into the College almost exclusively to the graduates of the *English* universities?—Yes; I am acquainted, I think, with the general principles upon which the College is governed under that head.

"Out of what circumstances do you think the practice referred to, which is not according to the original by-laws of the College, arose?—From the original connexion between the Universities and the College. The first founder of the College, Linacre, established lectures at Oxford. The successor of Linacre founded a college at Cambridge, Caius College; and there has been a natural connexion between the University and the College of Physicians ever since."

What a tissue of false reasoning and absurdities! This clever President traces an "original connexion" between the Universities of Oxford and Cambridge and the College of Physicians. Why? Because HENRY the EIGHTH was the founder of the College, and, of course, because ALFRED was the founder of the Universities! Thus, exclaims this sagacious casuist, a "*natural* connexion" exists between the Universities and the College of Physicians! Most *un*-natural, Sir HENRY, and from this very obvious cause,—the College of Physicians is a medical, and the English Universities have ever been a *non*-medical, institution. If a connexion is to be traced to the identity of the *founders* of institutions, it may with equal propriety be alleged that there is a "natural connexion" between the founder of the LONDON UNIVERSITY and the UNION WORKHOUSES about to be erected under the new *Poor-Law Act*, as it is said that both are indebted for their origin to the exertions of the Lord Chancellor BROUGHAM. Or, why not trace a connexion between the College of Physicians and the jails that were erected during the reign of the eighth

HARRY, — establishments indebted for their existence to the enterprising mind of that very benevolent monarch! The question which was necessarily suggested to the Chairman, was proposed as follows:

"Are you not aware that for nearly two centuries after its first institution, admission into the College was given to the graduates of foreign Universities, provided they could produce testimonials of admission *ad eundem* at one of the English Universities?—I believe there are instances of that; but it has not been the common practice. Certainly Sydenham was not a fellow of the College.

What an answer! And then came this question. The reader will bear in mind that we can vouch for the accuracy of our report, as the evidence was taken *verbatim*.

"Have you examined the early admissions into the College sufficiently to satisfy yourself that a great number of those admitted were graduates of foreign Universities?—I have not made it my business to examine particularly the former arrangements of the College; I am satisfied with the practice of the College for the last 150 years, at least. I know there have been disputes upon that subject, and that the statutes have been altered from time to time. I know, morever, that they have always been subject to legal revision, within the last eighty or ninety years, before they have been put into force, and acted on as to their legality."

Who is to understand what meaning such a witness as this intends to convey by his replies? Notice particularly the two parts of the first sentence in this last answer. He "has *not* made it his business to examine the former arrangements of the College, but he is satisfied with the practice of the College *for the last hundred and fifty years* at least." The "former" part, therefore, he referred to a period antecedent to A. D. 1684! The learned President having declared that he was satisfied with the practice of the College during a hundred and fifty years, he was then questioned as follows:—

"You are aware that up to a comparatively recent period, a statute was prevalent in the College, restricting the Fellows to a certain number?—Yes, there was such a statute.

"That statute prevailed up to the middle of the last century. Was not that statute declared to be illegal by Lord Mansfield?—I think I recollect his judgment to that purport.

These questions, considering the nature of the previous answer, were admirable. The President was here made to declare, that Lord MANSFIELD had pronounced that conduct of the College to be "*illegal*," of which Sir HENRY had previously expressed his unqualified approval. All the Presidents of the College of Physicians have betrayed a marked partiality for unlawful government. No wonder, therefore, that the witness had been delighted with the exclusive and persecuting acts of the College "during the last hundred and fifty years at least."

With a selection of questions and answers relating to the admission of licentiates to the Fellowship, or rather the exclusion of those gentlemen from that "dignified rank," we shall adjourn the inquiry to Saturday, September the 6th.

"Has the College any reason to doubt, at present, whether the by-law restricting the admissions, except under certain circumstances, to the graduates of Oxford and Cambridge, is a lawful restriction or not?—I take it to be an election, and quite at the option of the College. If a person is once licensed, they may take that person into a fellowship whenever they please, after ten years. That is the rule; he is eligible into a fellowship after ten years.

"You are now referring to a special statute of the College made subsequent to the year 1765, allowing any Fellow to propose a licentiate for election into the order of candidates, provided he had been a licentiate ten years?—It is not confined to the proposal of a Fellow, but the President has the power.

"There are two dispensing by-laws; the first is, that the President may propose a certain number of licentiates within a certain interval; and the other, that any Fellow may propose a licentiate of ten years' standing, at any time?—Yes; that is the statute at this moment.

"How many licentiates have been elected into the College on the proposal

of a Fellow, from the first passing of that statute down to the present time?—I do not know that any one has been elected; but I do not know why they have not been elected. I know very well, that one was proposed a very short time ago, and that he probably would have been elected, but that he died before the period of election could come on.

"You are aware that, at the time of the trial in the Court of King's Bench, in the case of Dr. Stanger, this by-law was referred to by the counsel of the College, as so qualifying the old restrictive by-laws, as to remove the objection which Lord Mansfield made to them, as being too narrow. The by-law was represented as one by which the licentiates could gain admittance into the College. Upon this assumption, Mr. Justice Lawrence observes, 'Where is the difficulty of a gentman getting some one Fellow of the College to propose him?' Dr. Stanger's counsel observes in reply, 'There has been no person admitted; there have been many trials, but nobody has ever got through that wicket, or ever will.' The view taken by Mr. Law, that the statute was never intended to be acted upon, seems to have been very correct; for, from the time of its first enactment, not a single Fellow has ever found admission under it into the College?—I do not know what the reason is which prevents a person from being so proposed. He is to be submitted to an examination, and that might deter persons from wishing to be proposed.

"Are you aware, that in 1789, after the passing of the statute, Dr. Burges, a Fellow of the College, proposed a licentiate, Dr. Sims; and the objection then taken was, that the proposal was not seconded, whereas no mention of the necessity of there being a seconder was to be found in the statute itself; and Lord Kenyon, upon the hearing of Dr. Stanger's case, expressly says, that no seconder is necessary. The words of Lord Kenyon are, 'If it had been a *sine quâ non*' (meaning by *if*, the having graduated at Oxford or Cambridge), 'if it had controlled the parties who are to form their judgment, and taken from them all power of decision upon candidates, it would have had that seed of death in it that Lord Mansfield found in the by-law, which he decided to be bad. But this is not so; here every person has a right to address himself to the honourable feelings of those breasts to which Dr. Stanger must at last have addressed himself, if this mandamus went. If they find him to be (as I am inclined to believe he is, from what I hear of him) possessed of all the requisites of medical learning and moral character, he will address as powerful arguments to those gentlemen, every individual of whom is called upon to exercise his opinion upon the subject. He is not to wait to be seconded; the by-law does not require that. If any one proposes him, the question is submitted to a majority; it goes then to that tribunal which, I hope and believe, is the sanctuary of honour and good faith; and he may as well address himself to them now, as if this mandamus went.' In 1789, previous to this opinion given by Lord Kenyon, Dr. Burges, a Fellow, proposed Dr. Sims, a licentiate; and the objection was taken, that as the proposer was not seconded, they could not go to the ballot. Accordingly, in examining your annals, it appears that no entry whatever is made of that proposal, because it was not seconded; and in the return made by the College last year to Parliament, of the number who have been proposed and rejected in each year, there is no notice of any one having been proposed and rejected in the year 1789. Are you aware that a person under this by-law was proposed to the College for the first time in 1789, and that they did not even go to the ballot on the proposal, upon the plea that it was not seconded?—I am not aware of it.

Indeed! that is somewhat strange, considering you have been "satisfied with the practice of the College for the last hundred and fifty years at least!"

The next point in the examination, referred to the insults offered by the College to the well-known and highly-respected Dr. W. C. Wells.

EMETICS OF COMMON SALT IN CHOLERA.

[The following remarks were appended to the "Clinical Observations" of Mr. Wardrop on certain tumours of the mouth, which were intended for publication in our present Number, but which want of space has prevented us from inserting this week. The shortness of the subjoined paragraphs enables us to give them at once.]

The judicious and, at this moment, important observation on the use of emetics of common salt in the treatment of cholera, which were communicated in the last Number of The Lancet by Mr. Beaman, induce me to give publicity to a letter which I have lately received from Dr. Hoskins, of Guernsey. His experience confirms strongly the observations of Mr. Beaman, and although I am not authorized

by Dr. Hoskins to publish his remarks, yet the prevalence of the fearful disorder which is now raging will, I am persuaded, be sufficient apology to him for my making this use of his communication.

"When the disease visited us two years ago, we found common salt and water the best remedy. Its superiority to any other plan forced itself upon our attention, and our Cholera Hospital became extremely popular as a medical asylum, with all ranks and classes. I may mention, that out of sixty-two cases, admitted into the hospital in the third stage, and treated solely with solutions of salt, forty-six recovered, and only sixteen died, whereas the mortality following the opiate and stimulant treatment was about sixteen in thirty-seven. At first I adopted the opiate plan, but soon afterwards became a convert to the saline.

(Dated) "Guernsey, Aug. 16th, 1834."

EXCLUSION FROM THE CANTERBURY HOSPITAL.

To the Editor of THE LANCET.

SIR,—I beg leave to forward to you the following statements, premising that previous to my entering into partnership with another medical gentleman who has an open shop for the sale of drugs, I was quite welcome to attend the practice and operations of the "Kent and Canterbury General Hospital."

Calling accidentally at the Hospital on Thursday, August 21st, I learned that the surgeons were consulting about a case of strangulated hernia,* and that their opinion was, that an operation should be forthwith performed on the patient. Desirous of witnessing this as well as other operations, at which I had been formerly invited to attend, I requested the house-surgeon to "present my compliments to Mr. Major (the person about to operate), with a request that I might know whether I could be allowed to see it." The answer from Mr. Major and his colleagues was in the negative, accompanied by a remark that if any person who was a vender of drugs intruded himself into the operating theatre, it was the duty of the surgeons to take up their hats and walk. This, Sir, comes with ill grace from a man who himself a short time since *kept an open shop*, where a physician of this very hospital attended to give "advice gratis," and who closed it only because it would not answer. This also is the man who some time back declared openly that every medical man was at liberty to attend the operations. The inhabitants of Canterbury are well aware of the irregularity of the surgical attendance in this Hospital. It has been a frequent subject of animadversion among them, and this may account for the anxiety of the medical officers to maintain the "hole-and-corner system" of which the present is an instance. I am, Sir, your obedient servant,

W. K. LOVELESS, M.R.C.S.L.

41, Palace-street, Canterbury,
August 24th, 1834.

* Was this really a case of strangulated hernia, or a simple abscess similar to one which some of these surgeons cannot fail to remember? W. K. L.—[We withhold the details of the case mentioned, as well as the remarks on another case related by Mr. L. The medical officers will hardly persist in their refusal to admit to the operations a member of the College, whose conduct in the Hospital is free from reproach. —ED. L.]

MR. SHEPHERD'S REPLY TO MR. GILL.—Mr. Shepherd has addressed a letter to us (in reply to the assertion of Mr. Gill, contained at page 780 of our last No.), from which we extract the following passages:—"I am ready to prove at any time that my forceps, and the forceps of Mr. Fay, are as widely different as forceps can be; that I never saw Mr. Fay's forceps until Thursday last, four months after publishing my first account: and that this Mr. Gill, who has the presumption to accuse me of pirating Mr. Fay's instruments, acknowledges to me that, at the time of addressing his letter to you, he had never seen my forceps. Consequently he could know nothing of the subject. In Mr. Fay's account, published in 1826, I do not so much as see the word *stump* alluded to.

"53, Baker-street, Portman-square.
"Aug. 23."

Dr. AYRE, of Hull, has requested the corporation of that town to organize a commission of six persons, half the number being of the profession, to visit 20 patients in a series, whom he may be called to attend in the malignant cholera, and report on the nature and results of his treatment. As a motive for this request being granted, Dr. A. stated, that from experience acquired in 220 cases, treated by small and frequent doses of calomel, wholly unaccompanied by other means, he was prepared to demonstrate, that, by this method, cases which are otherwise confessedly incurable, may be cured with comparative facility, even from

a state of collapse; and that the report issued would lead to most important and beneficial changes in the treatment of the complaint.

Mr. W. Batten, of Southwark, has forwarded to us a paper on the beneficial effects of what he terms "cera phosphorata" in cases of malignant cholera, but as we have not room *at present* for its insertion, and more especially as we can refer our readers to a communication of that gentleman on the same subject, published in No. 521 of The Lancet, we must content ourselves with acknowledging in this place the receipt of his letter, simply adding that Mr. Batten says "he has now watched the effects of the remedy during two seasons of cholera, and has treated many cases, during both periods, with the same uniformity of result—a highly successful one." Mr. Batten's paper contains details of several cases (attacks of this year), in which the disease was subdued by the "Pil. Ceræ Phos." In making a selection of papers for insertion, those illustrative of the effects of salt-water emetics must, just now, for reasons which need not be repeated, have the preference over long communications advocating other plans.

Affairs are in so flourishing a condition at King's College, that the Professor of Botany is delivering lectures on that science at Sheffield. The Professor of Zoology lately spent his season in Germany.

Knighthood was conferred by the King, at St. James's Palace, on the 20th instant, on Dr. D. J. H. Dickson, Physician to the Naval Hospital at Plymouth.

CORRESPONDENTS.

To a friend who writes as a "plain man," we may observe, that "cheapness" is but a relative term. It is not always twin with excellence. Unless *not* to praise is injustice, we did justice. Complaints have reached our ears, but believing that the disposition existed to unite goodness and cheapness, we presumed the faults to be temporary only, and were silent. We stand between two parties, and endeavour to be just to both. Those points which we may leave unnoticed, or notice but slightly—the *cheapness*, by-the-by, was noticed on two or three occasions—are proper topics for advertisements. They afford fit materials, as we have seen, for the *pages* of some of our contemporaries, but for the *cover* only of The Lancet. The documents forwarded by our correspondent shall be taken care of.

Juste Milieu. The plot probably is not yet ripe. The plotters want either ingenuity or courage.

A notice of the presentation of a piece of plate to Dr. Thompson is excluded this week from want of room.

A Correspondent. Want of space will oblige us to give but a brief account of the proceeding.

"*The Father of Nine Children.*"—An examination of the indices, article "Reviews," will enable our correspondent to discover the title. Memory and time do not serve us to give an exact answer. We may observe, however, that he will find the work by Mr. H. Rees, "On the Management of Children," an excellent volume. Its pages are replete with sound and useful advice.

Dr. Bain's case of ascites of three years' duration, cured with the hydriodate of potash, next week.

We are compelled to postpone the letter and sketch, forwarded by *Mr. Bloomfield*, until next week.

Mr. Horne's letter, dated Aug. 23, shall appear; so also shall his other communication, as soon as space will admit.

The letter of *Mr. Blackwell* is an advertisement.

The reply of *Mr. Cheyne* has reached us, but we must have liberty to divest the controversy of every extraneous sentence, or an entire Number, we can easily foresee, will not contain the inevitable correspondence.

An Old Subscriber. (This week.) Arrangements have just been completed, which will amply supply the deficiency. One great and paramount public object rendered it necessary to make that which he terms "subordinate" a very prominent feature. The end is happily on the eve of accomplishment,—to our minds a proof that the judgment which dictated that feature, did not operate unwisely, or unprofitably for the profession. However, the wish of our correspondent will shortly be gratified. It is also our own. By-the-by, the first remark in his letter is a remarkable error, as a careful examination will prove.

We intend the letter signed *J. L.* (Lord Lowther) for insertion next week.

Delta's letter reached us only just as our present No. was ready for press.

The letter from our *Dublin Correspondent* will appear in our next.

The letters of *Mr. Wm. Tait*, *Mr. F. A. Langworthy*, and *Mr. T. Barrett*, are intended for insertion.

W. W. They are too long for enumeration here. He should apply by letter to the Principal or Warden of the University.

The letter of *Mr. Cotter* has been received.

Notice.—It is particularly requested that all letters of business forwarded to the Office of The Lancet,—whether they relate to the contents of the journal, or refer to transactions connected with the Commission Department,—be invariably addressed to the Editor—Mr. Wakley. If this rule be not observed, it is impossible to guard against the impositions of anonymous scribblers who appear to have no other employment or pleasure than that of subjecting the conductors of journals to a heavy extortion in the shape of post-tax. If all letters of business transmitted to the office be addressed to the Editor, and no letters, unless so addressed, be received except the postage be paid, impositions will be effectually prevented.